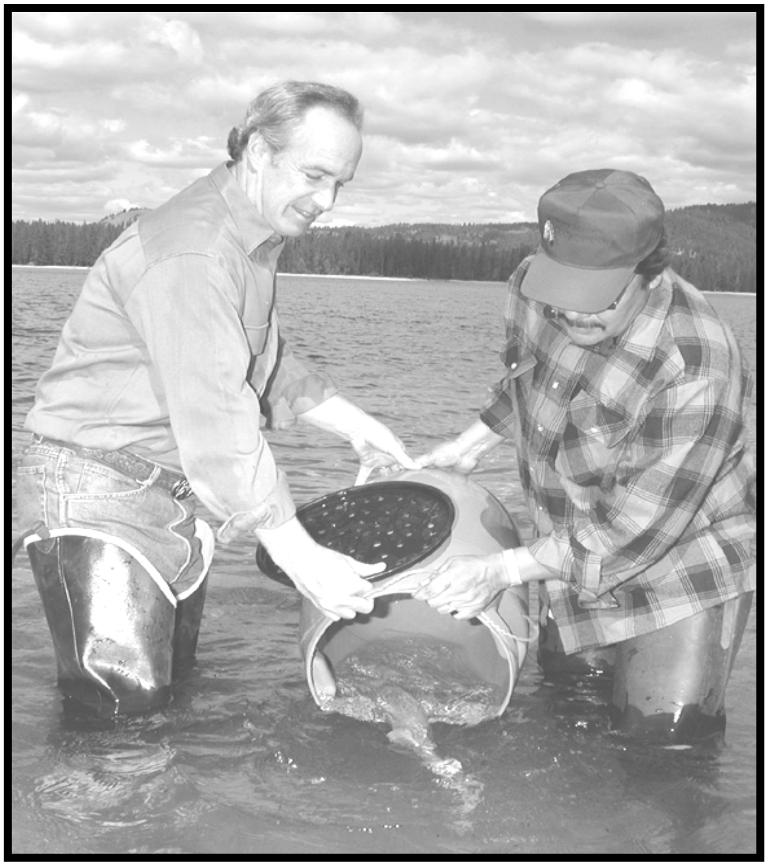
COMMENTS OF THE STATE OF IDAHO

FEDERAL CAUCUS
CONSERVATION OF COLUMBIA BASIN FISH:
DRAFT BASIN-WIDE SALMON RECOVERY STRATEGY
(FINAL DRAFT ALL-H PAPER)



DIRK KEMPTHORNE
GOVERNOR

SEPTEMBER 29, 2000

Cover: Governor Dirk Kempthorne and Shoshone-Bannock Tribes Council member Larry Bagley release a sockeye salmon from the Idaho Department of Fish & Game captive brood stock program into Redfish Lake September 6, 2000.

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The obvious purpose of the requirement that each agency "use the best scientific and commercial data available" is to ensure that the [federal Endangered Species Act] not be implemented haphazardly, on the basis of speculation or surmise. While this no doubt serves to advance the ESA's overall goal of species preservation, we think it readily apparent that another objective (if not indeed the primary one) is to avoid needless economic dislocation produced by agency officials zealously but unintelligently pursuing their environmental objectives.

Bennett v. Spear, 520 U.S. 154, 176-77 (1997).

I. INTRODUCTION

The following are the comments of the State of Idaho on the Federal Caucus' July 27, 2000, publication entitled "Conservation of Columbia Basin Fish: Draft Basin-wide Salmon Recovery Strategy" formerly referred to as the "All-H Paper." Hereinafter, the Draft Basin-wide Salmon Recovery Strategy will be referred to simply as the "Conceptual Recovery Plan" or "Plan."

Comments provided by the State of Idaho in response to the July 27, 2000, Federal Columbia River Power System (FCRPS) Biological Opinion ("FCRPS BiOp") prepared by the National Marine Fisheries Service (NMFS) are hereby incorporated by reference. The State intends to timely supplement these comments as appropriate.

A. PREFACE

Idaho makes these comments and sets forth its recommended actions with the understanding that the current decision making framework by NMFS is that breach of the four lower Snake River dams will not occur in the near term. If within the next five-year period the status of these dams or any other major component of the FCRPS has changed, Idaho will take this in to account for possible reevaluation of recovery planning.

The Plan's analysis of each of the "H's" [Habitat, Hatcheries, Harvest, and Hydropower] will be assessed. Idaho will use this assessment to maximize the dedication of resources to the problem of salmon recovery. A fifth "H" - Humans - is factored to assure an appropriate balance in the measures applied for the solution. Each of the discussion units will include Idaho's particular perspective as well as that of the recent Four Governors Recommendations.

B. SUMMARY OF COMMENTS

The operation of hydropower projects have undoubtedly benefited the economic vitality of Idaho and the Pacific Northwest. With twelve evolutionary significant units ("ESUs") listed under the Endangered Species Act spread across the Pacific Northwest (eight below the four lower Snake River dams and four species which return as adults above the dams), it is evident that there are many significant factors that are responsible for the decline of the stocks. The Executive Summary acknowledges that "new research suggests that the greatest opportunities for survival improvements may lie outside the scope of the hydropower corridor," (Vol. 1, p.1-2), and Idaho agrees with the Caucus that "[s]uccessfully implementing actions in the habitat, harvest, and hatchery sectors will be necessary for salmon recovery, regardless of the ultimate decisions by Congress on the subject of reconfiguring federal dams." (Vol. 1, p.10). The State adds that freshwater and ocean habitat should be factored into the proposed action.

Idaho is concerned about performance standards and deadlines contained in the Plan and in the FCRPS BiOp. The BiOp sets performance standards within each "H." However, the structure of the performance standards across all of the H's render it extremely difficult to ascertain if they are being met, thus leaving them open to manipulation and interpretation. This scenario sets the stage to hold the FCRPS accountable for any failure to meet performance standards regardless of whether these standards are met because of FCRPS effects, effects caused by other human-caused activities, or natural effects. The State of Idaho supports off-site mitigation that is spread proportionately across the H's if it is accountable and has a reasonable nexus to the lifecycle improvement for which it is targeted.

But Idaho continues to question whether *more* water needed by Idaho irrigators and municipalities should be spared to satisfy an unsubstantiated biological benefit. To Idaho, the assets dedicated to answering these questions are only one factor in what must be, out of necessity, a regional effort in improving the vitality of the species.

Additionally, while the State supports improvement across all of the Hs, it does so with the assumption that the role of Idaho in achieving success will be paramount, and that state law and state processes will be respected by the federal government. These concerns include respect for private property rights and that voluntary habitat improvement will occur on a willing buyer/seller basis pursuant to state law.

C. BACKGROUND

A newborn wild salmon Pacific Northwest enters the world with a dubious distinction: it is immediately protected under the Federal Endangered Species Act (ESA). Such a pedigree means that no one can *touch* these species absent legal authorization or consequence. As the young anadromous[1] fish begins its outbound journey to the Pacific Ocean where it will spend the majority of its life, it must overcome many obstacles including

1. Anadromous species are defined by federal law as a "species of fish which spawn in fresh or estuarine waters of the United States and which migrate to ocean waters." 16 U.S.C. § 1802(1).

hydropower projects, predators, and poor estuary conditions, and an ever-changing ocean environment.

The fish matures for several years perhaps in less-than-optimum ocean conditions and must eventually make its way back to its original spawning grounds. The return trip is just as challenging, which could include commercial fishing nets, marine mammal predators, and lawful treaty harvest. Thus, the fish must be the beneficiary of a miracle if it is to return to its native river, reproduce, and end its life.

The federal government has issued the FCRPS BiOp, which is a guide to all short and long term actions which may *potentially* impact the Northwest's listed salmon species. The ESA requires that the BiOp be formulated using the best science available.[2] The most vociferous advocates of the ESA argue that economic considerations are not entitled to obfuscate what should be scientific deliberations focused solely on species recovery.[3]

However, as recently stated by the United States Supreme Court, "uneconomic (because erroneous)"[4] decision making is inconsistent with the ESA. Measures taken to implement recovery decisions must have sound grounding in economic reality, even if such science dictates that the cost of such measures are incalculable. Accordingly, any solution to the problem of salmon recovery in the Pacific Northwest must be biologically competent, affordable, and politically supportable throughout the region.

1. The Endangered Species Act: The Law of Salmon Recovery

Under the ESA, an endangered species is a species "which is in danger of extinction throughout all or a significant portion of its range . . .."[5] Threatened species are defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."[6] A decision to list a species as "endangered" or "threatened" under the ESA must be made "solely on the basis of the best scientific and commercial information available."[7] The ESA requires each federal agency to "insure that any action authorized . . . or carried out by such agency . . . is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary . . . to be critical . . .."[8]

2. 16 U.S.C. § 1536(a)(2) ("In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available.").
3. *See, e.g.*, Fedrico Cheever, *Butterflies, Cave Spiders, Milk-Vetch, Bunchgrass, Sedges, Lilies, Checker Mallows and Why the Prohibition Against Judicial Balancing of Harm Under the Endangered Species Act is a Good Idea*, 22 WM. & MARY ENVTL. L. & POL'Y REV. 313, 314 (1998) ("The Endangered Species Act, as currently administered, cannot tolerate judicial balancing of species harm and economic dislocation while still honoring the purpose of the statute – the preservation and recovery of protected species and the ecosystems on which they depend.")
4. Bennett v. Spear, 520 U.S. 154, 177 (1997).
5. 16 U.S.C. § 1532(6).
6. *Id.* § 1532(20).
7. 16 U.S.C. § 1533(b)(1)(A).
8. 16 U.S.C. § 1536(a)(2).

If an agency determines that an action it proposes to take may adversely affect a listed species, it must formally consult with the "Secretary."[9] After consulting with the Secretary, the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) must provide the agency with a Biological Opinion explaining how the proposed agency action will affect the species or it's habitat.[10] If the USFWS or the NMFS conclude that the proposed action will jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat[11] the Biological Opinion must outline any "reasonable and prudent alternatives" (RPA) that either agency believes will avoid jeopardy to the species.[12]

If a Biological Opinion concludes that agency action will not result in jeopardy or adverse habitat modification, or it offers reasonable and prudent alternatives to avoid jeopardy, then the Biological Opinion must contain an incidental take statement. An incidental take statement must specify the "impact of such incident taking on the species" and any "reasonable and prudent measures that the [USFWS or NMFS] considers necessary or appropriate to minimize such impact."[13] The Biological Opinion is also required to set forth "the terms and conditions . . . that must be complied with by the Federal Agency . . . to implement [those measures]."[14]

2. The Science Driving Recovery Effort: The FCRPS Biological Opinions and Overview of Current Operations

a) The 1992, 1993, and 1994 Biological Opinions

The road leading to the FCRPS BiOp has been long and arduous. After the first of the salmon species was listed in 1991, the NMFS issued the first of what would become multiple biological opinions governing federal agency operations in the FCRPS. Each of the significant biological opinions issued by NMFS covering the FCRPS has been tested in a judicial environment.[15]

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9. The "Secretary" refers to the Secretary of the Interior, who has delegated responsibility to the U. S. Fish and Wildlife Service (for terrestrial species) or the Secretary of Commerce, who has delegated similar responsibility to the National Marine Fisheries Service (for marine species). *See* 50 C.F.R. § 402.01 (b) (1998).
10. 16 U.S.C. § 1536(b)(3)(A).
11. *See id.* § 1536(a)(2).
12. *Id.* § 1536(b)(3)(A).
13. *Id.* § 1536(b)(4)(C)(i)-(ii).
14. *Id.* § 1536(b)(4)(C)(ii).
15. Idaho Dep't of Fish & Game v. National Marine Fisheries Serv., 850 F.Supp. 886 (D. Or. 1994), *vacated as moot*, 56 F.3d 1071 (9th Cir. 1995) (challenge to the 1993 Biological Opinion); American Rivers v. National Marine Fisheries Serv., 126 F.3d 1118 (9th Cir. 1997) [American Rivers I] (challenge to the 1994 Biological Opinion). 168 F. 3rd 497 (9th Cir. 1999) [American Rivers II] (unpublished decision) (challenge to the prospective adoption of the salmon transportation measure contained in the 1995 Biological Opinion). *See American Rivers v. National Marine Fisheries Serv.*, 126 F.3d 1118, 1122-23 (9th Cir. 1997) (discussing procedural chronology of the FCRPS biological opinions).

The first FCRPS biological opinion in 1992 concluded that the operation of the Columbia Basin hydropower projects would not jeopardize the listed species.[16] The NMFS subsequently issued a biological opinion on the 1993 hydropower operations[17] which the Idaho Department of Fish and Game challenged as arbitrary and capricious decision making.[18] The United States district court held that the 1993 BiOp violated the ESA by: (1) adopting an arbitrary scientific basis by which to measure progress of the listed species; (2) discounting low probabilities in the modeling of the effects; (3) ignoring the recommendations of state and Indian Tribal scientists.[19]

On March 16, 1994, NMFS issued a biological opinion for the FCRPS operations during the years 1994-1998.[20] The 1994 BiOp was issued several days after the United States District Court struck down the 1993 BiOp, and, in light of the judicial decision, the federal agencies reinitiated consultation on that 1994 BiOp.

b) The 1995 Biological Opinion

The NMFS subsequently released a new biological opinion in March 1995, which continued barging and trucking of listed species and increased spring and summer flow augmentation.[21] Environmental organizations, as well as the State of Oregon, sued the NMFS alleging that the 1995 BiOp would jeopardize the survival of salmon.[22] The 1995 BiOp, with its forward-looking proposed actions, withstood these attacks and was upheld.[23]

c) The 1999 Bureau of Reclamation Biological Opinion

In a supplement to the biological opinions signed on March 2, 1995 and May 14, 1998, the NMFS determined that the proposed action of the Bureau of Reclamation (BOR) operations in the upper Snake River basin is not likely to jeopardize the existence of endangered or threatened salmon and steelhead.[24] In February 2000, the Earthjustice Legal

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16. *See* NATIONAL MARINE FISHERIES SERV., ENDANGERED SPECIES ACT SECTION 7 CONSULTATION/CONFERENCE BIOLOGICAL OPINION: 1992 OPERATIONS OF THE FEDERAL COLUMBIA RIVER POWER SYSTEM (1992) [hereinafter 1992 BIOP].
17. *See* NATIONAL MARINE FISHERIES SERV., U.S. DEPARTMENT OF COMMERCE, BIOLOGICAL OPINION ON 1993 OPERATION OF THE FEDERAL COLUMBIA RIVER POWER SYSTEM (1993) [hereinafter 1993 BIOP].
18. *See* Idaho Dep't of Fish & Game v. National Marine Fisheries Serv., 850 F. Supp. 886 (D. Or. 1994).
19. *See Id.* at 886-900.
20. ENDANGERED SPECIES ACT (ESA) SECTION 7 CONSULTATION REGARDING 1994-1998 OPERATION OF THE FEDERAL COLUMBIA RIVER POWER SYSTEM AND JUVENILE TRANSPORTATION PROGRAM IN 1994-98 (1994) [hereinafter 1994 BIOP]
21. ENDANGERED SPECIES ACT (ESA) SECTION 7 CONSULTATION BIOLOGICAL OPINION REINITIATION OF CONSULTATION ON 1994-1198 OPERATION OF THE FEDERAL COLUMBIA RIVER POWER SYSTEM AND JUVENILE TRANSPORTATION PROGRAM IN 1995 AND FUTURE YEARS (1995) [hereinafter 1995 BiOp].
22. *See* American Rivers v. National Marine Fisheries Serv., No. 96-384, (D. Or. April 2, 1997) (order upholding 1995 BiOp).
23. *Id.*
24. ENDANGERED SPECIES ACT (ESA) SECTION 7 CONSULTATION BIOLOGICAL OPINION BUREAU OF RECLAMATION OPERATIONS AND MAINTENANCE OF ITS PROJECTS IN THE SNAKE RIVER BASIN ABOVE LOWER GRANITE DAM: A SUPPLEMENT TO THE BIOLOGICAL OPINIONS SIGNED ON MARCH 2, 1995, AND MAY 14, 1998 (1999). [hereinafter 1999 BIOP].

Defense fund filed suit over the flow augmentation component of the 1995 and 1999 biological opinions.[25] The plaintiffs have alleged that the current flow augmentation regime is inadequate to satisfy the needs of the anadromous fish as covered by the 1995 and 1999 biological opinions.

3. The Four Governor's July, 2000 Recommendations

In an unprecedented effort and achievement in collaboration, the Governors of Idaho, Montana, Washington, and Oregon joined together to recommend actions and policies designed to recover our salmon. (Attached as Exhibit A, hereinafter "RECOMMENDATIONS OF THE GOVERNORS."). As with the Plan, these recommendations include actions to be taken in each of the H's.

a) Habitat

Specific recommendations pertaining to habitat include:

- Utilization of partnerships between local, state, tribal, private, and federal stakeholders
- Coordination and synthesis of CWA and ESA directives
- Development of local recovery plans
- Prioritization of fish passage projects;
- Improvements in the estuary;
- Management of predation;
- Continued study on the effects of the ocean on salmon survival; and
- Modification of management practices and strategies in the interior Columbia Basin.

b) Harvest

In reference to harvest, the four Governors recommend:

- A random observer program for ocean harvest in accordance with the Pacific Salmon Treaty;
- Harvest levels lowered sufficient to ensure survival;
- Support of terminal fisheries;
- Strengthened law enforcement; and
- Management of competitor species.

25. Trout Unlimited, *et al.* v. National Marine Fisheries Service, (D. Or.)(complaint filed February 17, 2000).

c) Hatchery

The Governors recognize that past hatchery reforms have contributed to decline of salmon. In order to ensure proper hatchery practices and supplementation procedures, the Governors recommend:

- Implementation of Artificial Production Review;
- Development of a comprehensive plan for artificial production; and
- Marking of hatchery fish that pose a threat to ESA listed fish.

d) Hydropower

Finally, with regards to the hydroelectric system, the Governors propose:

- Capital improvements at the dams, including measures that address water quality, temperature, and TDG that benefit the broadest range of species;
- Use of fish transportation as a transitional strategy;
- Use of spill testing and improved spill at dams; and
- Federal agencies must document the benefits of flow augmentation and the precise attributes of flow that may make it beneficial.

The Governors are rightfully concerned with funding and accountability as well. Independent scientific review and prioritization should inform funding decisions and accountability reports should be prepared. Congress should increase federal appropriations in recognition of the fact that salmon are a national resource and protection a federal requirement.

4. Socio-Economic Context of Salmon Recovery: The Fifth "H" – Humans

a) Water Development Projects

Stretching over 258,000 square miles and seven western states, the Columbia River Basin produces an average annual runoff of nearly 200 million acre feet (maf) of water.[26] Water development projects were first constructed in the Columbia River Basin in the 1800's which now is home to more than 250 significant dams. The Basin is thus one of the most highly developed river basins in the world.[27]

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26. Karl J. Dreher, *A View on Idaho's Experience with Flow Augmentation*, *in* COMPETING FOR THE MIGHTY COLUMBIA RIVER – PAST, PRESENT, AND FUTURE: THE ROLE OF INTERSTATE ALLOCATION, Apr. 30-May 1, 1998, at 1 (course materials for an ABA Section of Natural Resources, Energy, and Environmental Law conference in Boise, Idaho).
27. *Id.* at 2.

Beginning in 1961 and ending less than fifteen years later, the four lower Snake River dams were constructed by the United States Army Corps of Engineers (COE).[28] Ice Harbor dam was completed in 1961, Lower Monumental dam in 1969, Little Goose dam in 1970, and Lower Granite dam, the first dam downstream from Lewiston, in 1975.[29]

These four dams produce 1200 megawatts of power annually; power that is marketed through public utilities in Oregon, Washington, Idaho, and Montana by Bonneville Power Administration (BPA). This past summer's power shortages has highlighted the need for better reliability in the power grid of the Northwest.[30] The four lower Snake River dams are not economically insignificant, but the biggest benefit to the region, including Idaho, is the ability to provide power at critical times.[31]

One commentator has boldly concluded that "[t]he collapse of Idaho's salmon runs is the consequence of a Faustian bargain Idahoans have struck during the last half century. They have traded a deep-water port at Lewiston and cheap electric power for one of the most wondrous natural resources on the North American continent."[32] Those with reasonable perspectives on the issue of species recovery might cringe at such a stark portrayal of the confrontation between human and other species. However, it is undisputed that the potent combination of hydropower and water reclamation indelibly influenced the economic patina of the Pacific Northwest.

b) The Impact of Salmon Recovery on Idaho and the Region's Culture and Economy

Hydropower and reclamation projects provide a stable infrastructure and industrial base, as well as spurring the growth of Boise and other urban areas throughout the Northwest. Through it's hydropower projects, Idaho Power Company has been able to offer its customers the lowest electric rates in the country. Northwest electric ratepayers currently pay an average of forty percent below the national average.[33] Regional salmon recovery efforts have the real potential to unfairly burden Idaho's culture and economy.

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28. U.S. ARMY CORPS OF ENG'RS, DRAFT LOWER SNAKE RIVER JUVENILE SALMON MIGRATION FEASIBILITY REPORT/ENVIRONMENTAL IMPACT STATEMENT 2.2.1-2.2.4 (Dec. 1999).
29. *Id.*
30. *BPA Prepares to Help California in Stage 3 Emergency*, Bonneville Power Administration Web Site (visited September 27, 2000)<http://www.bpa.gov/corporate/kcc/nr/00nr/nr080100x.shtml>(stating that the "system is stretched and could possibly face shortages this winter if extreme cold temperatures occur."). *See also BPA: Energy Picture improving in the short term; Reliability still an issue*, Bonneville Power Administration Web Site (visited September 27, 2000) <http://www.bpa.gov/corporate/kcc/nr/00nr/nr06300x.shtml>(stating that "[p]ower supplies are having difficulty keeping up with demand, and our transmission systems are stressed too.").
31. *Id.*
32. Michael C. Blumm, *Saving Idaho's Salmon: A History of Failure and a Dubious Future*, 28 IDAHO L. REV. 667, 669 (1992).
33. F. Lorraine Bodi, *Salmon in the Balance*, in COMPETING FOR THE MIGHTY COLUMBIA RIVER – PAST, PRESENT, AND FUTURE: THE ROLE OF INTERSTATE ALLOCATION (Apr. 30-May 1, 1998)(course materials for an ABA Section of Natural Resources, Energy, and Environmental Law conference in Boise, ID).

The COE developed a cost-benefit analysis as part of the lower Snake River Juvenile Salmon Feasibility Report and Environmental Impact Statement (FR/EIS). This FR/EIS detailed the potential net present values for a variety of possible solutions to the problem of declining salmon runs. Depending on the alternative chosen, millions of people (more than four states, at least two nations, and several sovereign tribes) would be *directly* effected.

Indirect effects are substantially broader. The primary example is that of the Palouse area farmers who face the prospect of higher transportation costs, lower profits and lower incomes. They will be hard pressed to rebuild the long neglected rail and truck infrastructure rendered nearly obsolete by the barging system. The entire nation bore much of the cost of the system's initial construction and the entire nation participated in the benefits that have resulted. Accordingly, the entire nation should participate in the effort to return the salmon in the Pacific Northwest to a viable status.

At stake is the long-held belief that residents of the Pacific Northwest can simultaneously have a viable agricultural community, a viable industrial economy, and a healthy environment. For each of these values to remain viable, a thoughtful and meticulous balancing process must be engaged.

Further, decisions on prospective recovery measures must be made in an important context. Fish returns in Idaho, as well as throughout the entire region, have been encouraging. At Bonneville Dam, the cumulative count of adult fall chinook is 114% of the 10-year average to date. For steelhead, the cumulative count through Bonneville Dam as of September 21, 2000, was 136% and 131% of the 1999 and 10-year average, respectively. Adult spring Chinook at Lower Granite dam represent a thousand percent increase from 1999.[34]

34. Cumulative Adult Passage at Mainstem Dams Through 09/21, (visited September 27, 2000) <http://www.fpc.org/2000Daily/adultpassage.htm>.

II. GENERAL COMMENTS

A. COMMENT ON THE FIFTH "H"

IDAHO'S PERSPECTIVE:

REGIONAL SALMON RECOVERY EFFORTS HAVE THE REAL POTENTIAL TO UNFAIRLY BURDEN IDAHO'S CULTURE AND ECONOMY.

FOUR GOVERNORS RECOMMENDATION:

THE [REGIONAL] APPROACH MUST ADDRESS THE SO-CALLED "FOUR HS" OF HUMAN ACTIVITIES THAT INFLUENCE FISH AND WILDLIFE SURVIVAL -- HABITAT, HYDROPOWER, HARVEST AND HATCHERIES AND ALSO ACCOUNT FOR WHAT WE CALL THE "FIFTH H" -- THE IMPACT OF THESE ACTIONS ON HUMANS. STRATEGIES AND ACTIONS MUST BE BIOLOGICALLY SOUND, ECONOMICALLY SENSITIVE, AND SUFFICIENTLY FLEXIBLE TO ACCOMMODATE ALTERNATIVE APPROACHES DEPENDING ON WHAT WORKS BEST.

The Plan's principles rightly recognize that human activity will continue in the Columbia Basin.(Vol. 1, p. 25 (Scientific Principles); Vol. 1, p. 38 (Goals and Objectives)) While the overall focus of the scientific principles is species conservation, Idaho believes that it is imperative that the human factor, or the fifth "H," be given significant hierarchy among all of the other factors to be balanced in the plan. Without according the human element the appropriate weight, any regional consensus or cooperation to achieve the Plan's goals will be difficult, if not impossible.

The Caucus has minimized this factor in the Plan. While the human impact has been considered in the Plan (Vol. 1, p. 4) (conservation measures to be implemented "in ways that minimize their adverse socio-economic and other human effects."), Idaho is concerned that such impacts are not being given appropriate weight among the Plan's other goals. Any legitimate and reasonable recovery plan must address humans, as they comprise an integral part of the ecosystem.

Therefore, Idaho proposes that: 1) No measure proposed as a component of a regional salmon recovery should be considered without an appropriate factoring of the social and cultural costs; and 2) No measure shall be implemented until it has been assessed for its proportional biological benefit in furthering overall salmon recovery in relation to its cost effectiveness and collective public impact.

B. COMMENT ON SUPPORTING ANALYSIS (VOL. 1, P. 25)

1. Specific Principles

a) Generally

The Caucus has not clearly articulated a framework for biological analysis of activities affecting listed salmon and steelhead. After reviewing past biological opinions on several different categories of actions, no central principle or program that guides NMFS judgment under section 7 of the ESA is readily discernible.

Instead, NMFS has developed one or more separate standards for each category of actions (habitat, harvest, hatcheries, and hydropower). Although the Plan and draft biological opinion purport to supersede all previous publications, it is nevertheless useful to review examples of past biological opinions to illustrate the broad range of standards and outcomes possible under NMFS current approach.

- The 1995 BiOp called for the operations of the FCRPS to provide for a "high likelihood that the species' population will remain above critical escapement thresholds . . . and a moderate to high likelihood that its population will achieve its recovery level within an adequate period of time."[35]

- The biological opinion on federal efforts to control terns nesting on artificial habitat created by the U.S. Army Corps of Engineers stated that federal efforts are acceptable because any level of reduction in previous levels of avian predation - regardless of how small - is sufficient. The biological opinion predicted that levels of avian predation in the estuary of 10 percent to 30 percent would be reduced by one-fifth.[36]

Idaho does not set forth these examples to blame or exonerate any particular activity. The point is that the results of these biological opinions are difficult to reconcile. They reveal a fragmented application of the ESA that has led many groups in the region - from Indian tribes to ranchers - to feel that they have been singled out for an unduly harsh application of the ESA.

The Federal Caucus must work with the region to develop a plan that can assure our citizens that their contributions to salmon recovery are reasonable, biologically effective, and proportionate to the sacrifices asked of others. Further, the burdens placed on certain

35. 1995 BIOP at 14.
36. NATIONAL MARINE FISHERIES SERVICE ENDANGERED SPECIES ACT – SECTION 7 CONSULTATION BIOLOGICAL OPINION – CASPIAN TERN RELOCATION PROJECT 14, 21 (1999) [hereinafter CASPIAN TERN BIOP].

constituencies must be commensurate with the cause of the problem which is attempting to be addressed.

b) Specifically (VOL. I, P. 25)

At first blush, the specific scientific principles used to shape the recovery plan seem appropriate. However, there are some problems and inconsistencies amongst them.

The first principle is that conservation requires attention to *all* aspects of the ecosystem and species' lifecycle. This principle is important and supportable, but the Plan does not address the ocean aspect of an anadromous fish's lifecycle, a major oversight due to the fact that these fish spend a majority of their lives in the sea.

The second principle declares that natural systems functioning properly are necessary to restore salmon and steelhead. The use of the term "natural systems" is confusing because as long as any hydropower projects of the FCRPS are operational, there can never be a truly natural system. Because as the FCRPS BiOp sets forth a reasonable and prudent alternative assuming the operation of the hydro system, it contradicts it's own scientific principle.

Additionally, it is unclear whether the Plan is a consultation on the existence of the hydro system, or whether it is a consultation on the hydropower system's operation. The Caucus will need to clarify this uncertainty in order for this scientific principle to be applicable. Idaho supports and suggests that the BiOp and Recovery Strategy apply only to the operation of the FCRPS and not the existence of the FCRPS facilities. The Caucus should also define what is meant by "natural systems functioning properly." As noted in Idaho's comments to the FCRPS BiOp, the State disagrees with the this fundamental notion in the BiOp analysis.[37]

The fourth principle is that conservation requires re-establishment of the nutrient cycle provided by decaying fish carcasses. Since there is presently a lack of fish carcasses to spur the re-establishment of the nutrient cycle, nutrients will need to be added in the short term. The Plan does recognize that federal laws need to be "streamlined" (Vol.2, p.28), but it provides no solution as to how conflicting federal laws can be synthesized. The legitimacy of these scientific principles and the likelihood of effective implementation will remain in question until such a synthesis occurs.

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37. *See* State of Idaho's Comments *re*: Draft Biological Opinion On Operation of the Federal Columbia River Power System including the Juvenile Fish Transportation Programand the Bureau of Reclamation's 31 Projects, Including the Entire Columbia Basin Project (Dated July 27, 2000) at 13:

> The conceptual flaw in NMFS' approach to assessing Bureau impacts is that it focuses on the time that reservoir storage is released during the irrigation season and the consumptive use by the crops irrigated by this water. Because irrigation occurs primarily during the salmon migration season, NMFS assumes that Bureau projects have a substantial effect on flows during the migration season. This approach overlooks a simple but absolutely crucial fact: most of the water released from Bureau reservoir storage space for irrigation purposes was stored earlier in the year.

2. Scientific Tools (Vol. I, p.25)

The use of scientific tools is necessary and beneficial to any recovery strategy, and emphasis should not be placed on any one tool or outcome. However, it may become evident that some models or tools are more accurate and defensible than others.

Other tools NMFS should consider are common sense and simple logic. Common sense and simple logic indicate to Idaho that many improvements have been made to the fish facilities and operations of the FCRPS dams and reservoirs over the past three decades. The cumulative effect, which NMFS recognized, has been an increase in survival through the system (inriver) from 4 to 20% in the 1970's up to 40 to 60% in the late 1990's. Yet, NMFS continues to downplay this progress. Common sense and simple logic would indicate that efforts should be focused on maximizing juvenile fish survival through the FCRPS system and furthering ocean and estuary research to determine where and how young salmon utilize their ocean and estuary habitat.

III. SPECIFIC COMMENTS

The Conceptual Recovery Plan provides an excellent framework for assessing the needs and actions necessary to begin recovery of the species. A problem with the Plan, however, is that an idea in theory is not always capable of reproduction in practice. It is one thing to say that certain actions need to take place in each of the H's (habitat, harvest, hatcheries, hydropower) and quite another to implement them. The Plan lacks specifics on how those actions can be implemented, particularly given the inconsistencies in federal law and the related enforcement uncertainties.

A. GOALS AND OBJECTIVES (VOL. 1, P. 38)

Goals and objectives are necessary components for the success of any plan. However, there must be consistency among these goals and objectives.

Many of Idaho's concerns relating to the scientific principles used in the Plan apply to the Plan's goals and objectives as well. Two of the goals in the Plan are seemingly incompatible, which are to conserve species while simultaneously assuring tribal fishing rights and providing for non-tribal fishing opportunities (Vol. I, p. 38). The Caucus and NMFS admit that allowing harvest to continue exceeds the level of risk that would normally be tolerated, and that "biology supports elimination of all harvest." (Vol.2 p. 38).[38] This seeming inconsistency will be fully explored in the Harvest section, *infra.*

Another goal in the Plan is to balance the needs of other species. Idaho fully supports this goal, but believes that the Plan recommends action which would frustrate this goal, namely flow augmentation. The federal government must specifically document the benefits of flow augmentation before Idaho will consider jeopardizing our listed resident fish, irrigators, and others, and this is consistent with the consensus views of the Four Governors Agreement.[39]

Idaho believes an additional goal is necessary for incorporation into the Plan. This goal is to manage the salmon runs of the Columbia Basin commensurate with the changes in climate and ocean conditions that are occurring.

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38. *See also* Testimony of Governor Dirk Kempthorne Before the Subcommittee on Fisheries, Wildlife and Water, United States Senate 7 (September 13, 200)("Idaho continues to be perplexed that wild fish, listed under the Endangered Species Act, can be subjected to a regulated harvest at all. Can you imagine the hue and cry if the government suddenly declared a "harvest" season on the grizzly bear? I am sensitive to the industries in the Pacific Northwest that depend on a yearly salmon harvest, and I am similarly mindful of the harvest rights possessed by Native American tribes through treaties with our federal government."). (Attached as Exhibit B).
39. *See* RECOMMENDATIONS OF THE GOVERNORS at 9.

B. IMPLEMENTATION (VOL. 1, P. 40)

Idaho agrees that changes are needed to ensure the survival of Columbia River Basin steelhead and salmon populations. It is true that in *Idaho Dept. of Fish and Game v. National Marine Fisheries Service,* Judge Marsh stated that the "situation literally cries out for a major overhaul."[40] The situation does cry out for a major overhaul, but Idaho believes that the overhaul must first occur in the federal family's management of the situation.

Currently there are nineteen federal agencies, twenty-two state agencies, fourteen regional entities, thirty-seven local governments, fourteen ports, thirteen tribes and forty-four non-governmental organizations involved in managing and regulating the lower Columbia River. *See* Exhibit C. Currently, there are too many committees for the available personnel among the state agencies, tribes, Federal agencies, and others to provide meaningful participation.

The Plan exacerbates the problem by advocating the creation of a federal habitat team and the expansion of membership in the Federal Caucus. At volume 1, page 7, the Plan advocates long term management be conducted by ICBEMP on the east side of the Cascades and by the Northwest Forest Plan on the west side of the Mountains. The estuary will be managed by a different agency. This is not the kind of coordination that Idaho envisions, and is precisely the reason the Four Governors recommended that the President designate one official in the region to oversee recovery efforts and serve as a regular point of contact.[41] This type of management model will foster effective regional cooperation, which, in order to be truly successful, necessarily includes collaboration with state policy makers and scientists on issues pertaining to recovery measures aimed at impacting the complete life cycle of the species.

In volume 1, page 11, the Plan states that NMFS and the USFWS will ensure implementation in all the H's through biological opinions. NMFS may recommend actions to take place in each H, and assume improvement. However, while it may be within the purview of the agency to take into consideration its expectations that certain measures will enhance recovery efforts, the agency cannot extend its jurisdiction, through the FCRPS BiOp or otherwise, by attempting to require measures in areas, through enforcement efforts or other mechanisms, which are unrelated to the FCRPS or over which NMFS has no jurisdiction or authority. This is a matter, in part, of state sovereignty as well as statutory authority.

Rather, Idaho expects that existing state processes will be utilized as the conduit for on-the-ground recovery efforts. For example, the Idaho Legislature authorized the Governor's Office of Species Conservation to fulfill the state's need for an administrative

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40. 850 F.Supp 886, 900 (D. Or. 1994).
41. *See* RECOMMENDATIONS OF THE GOVERNORS at 4 ("As one step to achieve greater collaboration, we recommend the President designate one official in the region to over see federal agencies fish recovery efforts in the Columbia River Basin and serve as the regular point of contact with the states, local and tribal governments.").

infrastructure to assess, prioritize, and fund its species recovery programs.[42] This entity also acts as the appropriate liaison with the local governmental entities which will play an important role in program implementation.

The Plan asserts that it tries to account for natural cycles of environmental variation. While this is a worthy undertaking, Idaho is unable to discern where these variations are accounted for in the Plan. The Federal Caucus omits the importance of climate and ocean conditions, and candidly admits that little is known about the effects of the ocean upon salmon and steelhead. With no information, it is impossible for the Plan to account for this natural environmental variation. Another type of natural cycle of environmental variation is drought, yet performance standards in the FCRPS BiOp does not account for this variation.

42. IDAHO CODE § 67-818 -819 (Michie Supp. 2000).

IV. SPECIFIC COMMENTS ON THE HABITAT, HARVEST, HATCHERY, AND HYDROPOWER COMPONENTS OF THE CONCEPTUAL RECOVERY PLAN

IDAHO'S PERSPECTIVE:

THE DRACONIAN IMPACT OF THE FEDERAL ENDANGERED SPECIES ACT MAKES VOLUNTARY HABITAT RESTORATION, EVEN IF ESSENTIAL FOR THE SPAWNING AND REARING OF SALMON, LESS THAN DESIRABLE FOR PRIVATE LANDOWNERS AND THE STATES.

FOUR GOVERNORS RECOMMENDATION:

WITH SNAKE RIVER AND OTHER DAMS IN THE FEDERAL COLUMBIA RIVER POWER SYSTEM REMAINING IN PLACE, SYSTEMWIDE HABITAT IMPROVEMENTS THAT RESPECT PRIVATE PROPERTY RIGHTS, FOCUSED PARTICULARLY IN THE TRIBUTARIES AND THE ESTUARY, BECOME AN EVEN MORE CRITICAL COMPONENT OF SALMONID AND AQUATIC SPECIES RECOVERY.

A. HABITAT (VOL. 2, P.1)

The draconian impact of the ESA makes voluntary habitat restoration, even if essential for the spawning and rearing of salmon, less than desirable for private landowners and the state. Voluntary habitat improvement programs, provided they are economically feasible, designed to legitimately benefit salmon recovery and protective of property rights, should be encouraged by the states and funded by the federal government.

Additionally, Idaho questions the choice of priority sub basins (Vol. 2, p. 13). Only sub basins located below the Snake River dams were chosen. NMFS justifies this choice by arguing that the sub basins above the dams do not have sufficient spawners. This contradicts current data, ignoring the results of the 2000 return. Given the projections of twice as many chinook in 2001, NMFS should reconsider its choice of sub basins.

In reference to mainstem habitat, the Caucus states that "…we lack *basic* information on mainstem distribution and abundance of fish and their use - or potential use - of mainstem habitats. We also lack protocols for studies, monitoring and evaluation, and reference sites to monitor and evaluate changes." (Vol. 1 p. 21) It is questionable, then, how NMFS seems to know which mainstem reaches have opportunity for improvement and how improvement can be measured. NMFS also recommends *immediate* acquisition of mainstem habitat through purchase, lease, or other means (Vol. 2, p. 22). It is not evident what "other means" might be, but Idaho expects that state law and private property rights will be given appropriate consideration in this process.

NMFS lists as a priority (Vol. 1, p. 22) reconnection of alcoves, sloughs and side channels to the main channel twice per year. Allowing reconnection during normal to high water periods would be more logical.

The Forest Service and the BLM manage over 60% of currently accessible spawning and rearing habitat for anadromous fish in the Columbia River basin, located in the upper and mid-elevation portions of tributary areas. Therefore, the majority of tributary habitat has and will continue to be managed by the federal family. However, Idaho is committed to habitat improvements within its jurisdiction.

Idaho has four new project proposals currently in the works, in addition to ongoing projects to accomplish this goal. Some of these projects and accomplishments will be discussed later in this section. Idaho does not agree, however, that the Federal government should be given cart blanche to acquire additional habitat in Idaho. As it currently stands, the overwhelming majority of land in Idaho is owned and under the jurisdiction of the federal government. Idaho, as most states, has and will continue to experience growth. Idaho must be afforded the opportunity to manage this growth responsibly and with a viable economy. If habitat and or conservation easements are acquired, they should be acquired from willing sellers by the State within a legal process proscribed by Idaho. If water is acquired for conservation purposes, it should be done pursuant to state water law.

In reference to estuary habitat, the Plan supports predator control, but fails to explain how predator control can be legally accomplished. The majority of predators of steelhead and salmon are protected under federal law. Just as there are implementation barriers concerning the ESA and CWA, there are implementation barriers for predator control attributable to the Marine Mammal Protection Act (MMPA) and the Federal Migratory Bird Treaty Act (MBTA).

1. Overview of Current Conditions

Exhibit D-1 provides a vividly graphic depiction of vast differences in land ownership within the State of Idaho. The map clearly indicates that the overwhelming majority of land in Idaho is controlled by the federal government and also shows the lack of land controlled by the State within its borders. Exhibit D-2 shows that in two areas critical for anadromous fish, the Salmon and Clearwater basins, the federal government is responsible for 12,002,528 acres, or 77% of overall key acreage. The heart of the lands are federally designated wilderness areas.

River reaches in Idaho having outstanding values may be protected by comprehensive plans developed by the Idaho Water Resource Board or minimum streamflow water rights.[43] A river reach may be designated as a State Natural or Recreational River, or may be managed with respect to a minimum streamflow water right. Currently, 1800 miles have been protected as Natural Recreation Rivers. *See* Exhibit E. Additionally, the Idaho Water Resources Board holds water rights for minimum streamflows covering more than 920 miles of Idaho streams.

Within the Idaho anadromous fish habitat area, 214 stream miles are protected through minimum streamflow water rights. A Comprehensive Basin Plan for the Little Salmon River is also nearing completion. This and future comprehensive plans are expected to provide for additional protected river designations or minimum streamflow rights.

2. Habitat Restoration in Idaho

It is questionable how much additional benefit to salmon recovery can be achieved through improvements in spawning habitat, particularly in the near term. Over half of the available habitat for summer chinook and steelhead spawning lies within designated wilderness or in areas without roads and accompanying development. Other than fire suppression to protect watersheds, little else can be done to offer additional protection for these streams.

For streams subject to human activities, both state and federal statutes require that water quality sufficient to support salmonid spawning be protected. There are effective state programs to meet this mandate on state-owned and private lands, which comprise less than a quarter of available anadromous habitat. On federal lands, which contain 76% of the available anadromous habitat, similar protections are in place and being implemented.

Currently, there are streams capable of supporting salmonid spawning, yet this spawning is not occurring. There are also streams where the level of spawning activity is on the rise. For some streams total maximum daily load schedules (TMDLs) are being developed according to a court ordered time-frame. *See* discussion, *infra* pp. 35-39. Idaho hopes to accelerate this time frame for development of TMDLs.

Restoring water quality in degraded or sterile streams takes time. Some streams may never fully support spawning regardless of their water quality. However, there are no changes in either water quality standards or in programs to protect or restore water quality that can produce immediate gains for salmon recovery.

It is crucial that these programs receive adequate funds and are developed and maintained in partnership with local, state, and federal authorities to assure effectiveness.

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43. These are:
Lochsa River, Boulder Creek to mouth, 24 mi, 563-1140 cfs.
Selway River, Meadow Creek to mouth, 19 mi, 760-1500 cfs.
Middle Fork Clearwater River, all, 23 mi, 1323-2640 cfs.
Clearwater River, all, 79 mi, 1836-5910 cfs (3 applications) .
Salmon River, Whitebird to mouth, 53 mi, 4,000-31,000 cfs.
Pahsimeroi River, near May, Idaho to mouth, 7 mi, 45-74 cfs.

Exhibit F sets forth projects in Idaho that are presently funded by BPA. Idaho is committed to habitat restoration for the benefit of salmon recovery that is voluntary and provides for private participation.

The following case studies illustrate how habitat restoration on non-federal lands can be accomplished from a bottom-up approach, with support from local communities, instead of regulation from above. The touchstones of these programs are interagency cooperation and support by the state and federal government, and Idaho's experience is that finds these are the successful ingredients for voluntary habitat restoration efforts.

BURGDORF MEADOWS: A Fish and Wildlife restoration project recently approved by the Northwest Power Planning Council (NWPPC) protects spawning and rearing habitat for endangered summer chinook salmon in the Salmon River Basin. The habitat project is on Lake Creek, a tributary of the Secesh River in the Salmon River Basin, at an area known as Burgdorf Meadows near McCall, Idaho.

The portion of Lake Creek that crosses Burgdorf Meadows provides spawning and rearing habitat for summer chinook salmon and summer steelhead. Westslope cutthroat trout and bull trout also spawn in Lake Creek, rendering the area around Burgdorf Meadows important wildlife habitat. Lake Creek supports about 50% of the wild summer chinook salmon that spawn in the Secesh River Basin. Elsewhere in the basin, residential development has degraded spawning areas. Between 1980 and 1996, the Secesh drainage accounted for between 24 and 53% of all successful wild summer chinook reproduction in the Idaho portion of the Snake River drainage.

Recently, a landowner sold a conservation easement for the 94 acre meadow adjacent to Lake Creek to protect the area from residential development that may have diminished its value as fish and wildlife habitat. The landowner received $450,000, the fair market value of a conservation easement on the property which will be held in perpetuity.

Under authority of the NWPPC's Columbia River Basin Fish and Wildlife Program, BPA provided $420,000 and the remaining $30,000 was provided by the Rocky Mountain Elk Foundation. BPA's share came from money that had been allocated to two other fish and wildlife projects in Idaho. This transfer was recommended by the Columbia Basin Fish and Wildlife Authority (CBFWA), which represents the region's state, federal, and tribal fish and wildlife agencies, and was approved by the NWPPC. The Nez Perce Tribe and the Idaho Department of Fish and Game will be co-managers of the easement. The land remains in private ownership and continues to support the county tax structure.

THE CHALLIS IRRIGATION COMPANY: In the mountains of central Idaho, where endangered salmon spawn near the headwaters of the Salmon River, an old irrigation canal has been revitalized for the benefit of both agriculture and the fish. The ranchers pump Salmon River water from the canal to irrigate hay and grain crops. Government agencies, including the NWPPC, BPA, BOR, and the Shoshone-Bannock Tribe, are working to save salmon from extinction. For the irrigators, the Salmon River, a tributary of the Snake River, provides the lifeblood of the local agricultural economy. The farmers have legal rights to pump water from the river. For the agencies, a flowing river with adequate spawning habitat is critical to the future existence of Salmon River chinook salmon and steelhead.

These two interests could have been divergent, yet they were able to converge. The Challis Irrigation Company canal is owned and operated by the irrigators who use it. The canal irrigates some 3500 acres near the town of Challis, Idaho. Before the recent repairs, the original 1908 canal had a number of major problems. With irrigators doing most of the work, repairs were made, diversions were closed and consolidated, and fish screens rebuilt. Today the canal delivers water more efficiently than before, resulting in some 15,180 acre feet of water left in the river each year, and resulting in outward migration fish passage improvements.

GRAVITY DIVERSION: As a result of canal consolidation, some 600 acres of irrigated land east of Challis was converted from traditional field-flooding irrigation to sprinklers. In addition, crop yield can be increased by switching to sprinklers. Salmon benefit because more water remains in the river.

HANNAH SLOUGH: Just north of Challis, where the Salmon River sweeps through a series of turns, the spring -fed Hannah Slough is a prolific spawning and rearing area for salmon and steelhead. The springs in the Hannah Slough are recharged partly by surface irrigation. However, the river banks in this stretch are highly erodible and prone to significant shifts during floods. By stabilizing the river's south bank with rock, and by planting willow trees along the shoreline, the river will be less likely to flood Hannah Slough, which parallels the river.

LAVERTY CANAL: Like the Challis Canal the Laverty Canal is old - the water rights date back to 1885. Soon, the owner's irrigation will be switched from flooding to sprinklers with funding provided by BPA. This switch will allow several diversions to be consolidated into one improved diversion, with NMFS approved siting and screens. Approximately 15,000 additional acre feet of water per year will be realized, greatly improving outward migration conditions.

LEMHI MODEL WATERSHED: In 1992, as part of the Northwest Power Planning Council's plan to rebuild Columbia River salmon stocks, the "Lemhi Model Watershed Project" was established. This cooperative effort between agencies and landowners or land users has been very successful in improving anadromous fish habitat by utilizing improved water diversions, grazing plans, fencing and other measures.

In 1994, local governments, the Shoshone-Bannock Tribe and various citizen groups formed the "Lemhi County Riparian Habitat Conservation Agreement." This collaborative land use strategy is working to enhance and maintain effective riparian areas. These two successes constitute a model of how total maximum daily loads, or TMDLs might be implemented in other watersheds with similar, difficult problems.

The Lemhi Model Watershed, in cooperation with private landowners, local Soil Conservation Districts, Idaho Soil Conservation Commission and the Natural Resources Conservation Service, has substantially improved fish habitat on private land in the Salmon Basin. During the most recent period for which data is available (97-99), over 40 miles of fencing, in-stream improvement, and stream bank stabilization were completed. *See* Exhibit G.

In December 1999, the IDEQ completed its work on the Lemhi TMDL process under the federal Clean Water Act (CWA). This is important for two reasons. First, the Lemhi River and its tributaries are important spawning and rearing habitat for chinook salmon and steelhead. Second, while phase 1 of all TMDLs includes an assessment of all sources of pollution and an allocation of the total amount to each source, the subsequent phase of the TMDL is the implementation of measures needed to correct the problems. The existing management of the Lemhi watershed offers a significant preview of how TMDL implementation might proceed in an anadromous watershed.

CLEARWATER FOCUS WATERSHED: The Clearwater Focus Watershed, in cooperation with the Idaho Soil Conservation Commission, local Soil Conservation Districts, Natural Resources Conservation Service, and private landowners is playing an active role in improving fish habitat in the Clearwater Basin.

During the most recent period for which data is available (97-99), over 240,000 acres of private land within the basin had conservation systems installed or in use. These conservation practices, along with numerous structural practices including over 47 miles of fencing, stream improvements, grassed waterways, and terraces, have directly benefited anadromous fish habitat. *See* Exhibit H.

BLACKBIRD MINE: In April of 1995, the State of Idaho entered into a creative settlement agreement for the clean up of the Blackbird Mine located about twenty miles from Salmon, Idaho near the Frank Church River of No Return Wilderness.

In 1983, Idaho sued Norada Mining, Inc., N. P. Hannah Company for damages to state resources caused by heavy metal pollution from the Blackbird Mine. The United States Justice Department, on behalf of the U.S. Forest Service, the National Oceanographic and Atmospheric Administration (NOAA), and the United States Environmental Protection Agency (EPA) joined in the state's lawsuit to enforce the cleanup of the mine and restore injured resources. The federal government also sued the Alumet Corporation, the Union Carbide Corporation, and Machinery Center, Inc.

Since the 1800's, mining companies have extracted gold, copper, cobalt and other ores from the mine. By the 1960's, contamination from the mine had decimated the spring/summer chinook salmon run and the resident fishery in Panther Creek, and some of its tributaries. The landscape of Blackbird Mine included 4.8 million tons of waste rock, 2 million tons of tailings and an 11.5 acre unreclaimed open pit. Mine tailings and waste rock had been distributed over 128 acres of the mining site and surrounding national forest area.

As a result of the agreement reached with the State of Idaho and the United States Government, the mining companies agreed to clean-up Blackbird Mine and restore fishery and other resources compromised after years of mining activity. The settlement takes a progressive approach to the clean-up, wherein the mining companies have offered their expertise on the site to perform aspects of the clean-up and restoration wherein activities such as restoration of fisheries and other resources are left to government expertise. The biological restoration plan contemplates reintroduction of salmon to Panther Creek by the year 2005. Monitoring of water quality conditions would be performed by the mining companies until the year 2008, and maintenance of some of the habitat improvement will continue for the next hundred years.

Blackbird Mine represents a unique and innovative partnership between stakeholders to facilitate salmon recovery. Although the settlement is the end-product of litigation, the actual implementation of the site clean up consists of the joint private-public partnership which will most efficiently restore the essential habitat for listed fish.

BULL TROUT/ROAD CULVERTS: Idaho has implemented projects to remove fish migration barriers or made modification to barriers to allow access to habitat. While the focus has been on Bull Trout barrier modification as described in the Idaho Bull Trout Management Plan, work over the last three years has provided more of an inventory for barriers in anadromous waters as well as waters containing Bull Trout.

Idaho has completed 56 key bull trout watershed problem assessments, many of them in the Clearwater and Salmon drainage system. The problem assessments contain a good starting point for a data base of barriers that need to be reviewed, prioritized, engineered, and modifications constructed. A great deal of work has been done inventorying the fish passage barriers in the Clearwater drainage. The information is contained in 20 some reports. These have not been collated or brought together in one report. In the Salmon River upstream of the Middle Fork most, if not all, of the barriers have been identified and collated into a report. The lower Salmon from Riggins down to Whitebird needs to be inventoried. In addition, a review may be required of the South Fork of the Salmon and the Little Salmon, although the number of barriers is thought to be few.

The existing data for the Clearwater and Salmon basins should be collated, verified by a field inventory, and transferred to a GIS database. A priority developed for field inspections and engineering plans for modifications as well as cost estimates. The additional data would then be used to review the priority list for construction or repairs. Some repairs require very little, like placing a rock ladder in an existing culvert, while others like a culvert replacement in a major roadway could be more complicated and expensive. Some of the barriers may be associated with irrigation diversions, flows, and/or the screening program which will be described later. Although Idaho's focus has been on the Bull Trout barriers, more emphasis should and will be placed on the Salmon and Clearwater.

3. Screening

Fish screening in Idaho is important and should be accomplished through federally funded programs. The funding comes from two sources. The first source is Mitchell Act funds, which are administered by the National Oceanic and Atmospheric Administration (NOAA). The second source is Bonneville Power Administration (BPA), with the NWPPC review and approval. The Idaho Department of Fish and Game (IDFG) administers these funds through a program headquartered in Salmon, Idaho. Local landowners supply cost share funding on project by project basis.

There are three types of screens: infiltration, drum and pump. Infiltration screens prevent all fish entry. Drum screens meeting NMFS criteria (3/32" holes) screen all anadromous fish of all life stages. Some whitefish can escape through the drums. The pump screens meet NMFS criteria and prevent injury to all fish of all life stages. Sizes of fish screens vary relative to the volume of flow being diverted. The modular fish screen can handle up to 4.8 cubic feet per second (cfs). The single bay drum screen (one drum) can screen up to 10 cfs. A two-bay drum can screen up to 20 cfs and each additional drum screen 10 cfs.

At present, the State of Idaho has received some financial commitments for screening, but Mitchell Act funds are scheduled to terminate in 2003. After 2003, NMFS's fish screen requirements (including funding) will fall on the irrigator. If funding is available for 3 years, the Mitchell Act moneys would provide roughly $2,680,000 after overhead and capital outlay is removed. The State of Idaho and IDFG do not provide separate funding for these activities.

The fish screen program in Idaho uses two types of screens for pumps. One is a simple passive screen with no moving parts. It is used on small pumps typical of most domestic use pumps. On larger pumps a cleaning device is needed to keep the screen from clogging. Typically a sprinkler is used inside the screen to blow off debris and repel juvenile fish. The estimated costs for screening will reach into the millions of dollars.

Seventy-three screens have been installed, with anticipation of another 20 being finished by late fall, 2000. The IDFG constructs and installs the screens, and for private land based diversions, maintenance and operation then become the owner's responsibility. Pump intake screens can be completed at an approximate rate of 40 per year.

Ten years total time is required to complete the planned screening, but this time frame could be accelerated depending on the availability of funds. The surface and pump diversion work can progress simultaneously. The most time-consuming element in the screening process is the permitting relative to securing NMFS permits. By working together, the Idaho Department of Water Resources (IDWR), the Idaho Department of Environmental Quality (IDEQ) and IDFG could assist in negotiating a blanket permit for pump screens and a simplified process for surface diversions that could save both time and money.

4. Predator Control

a) Caspian Terns

(1) Background

Rice Island and East Sand Island, located near the mouth of the lower Columbia River, were built as a result of a channel dredging operation by the Army Corps of Engineers for ocean-going vessels. The major portion of Rice Island is located within the State of Oregon, while the northeastern tip of the island crosses into the State of Washington. East Sand Island, down river and west of Rice Island, is almost completely contained in Oregon.

These islands have become a prime nesting habitat for a colony of Caspian terns, a piscivorous bird species protected under the federal Migratory Bird Treaty Act (MBTA).[44] According to a recent environmental assessment conducted by the Army Corps of Engineers, a colony of Caspian terns located in the mouth of the Columbia River near Rice Island was estimated in 1984 at about 1,100 pairs.[45] The colony grew rapidly to 8,000 pairs in 1997, and most recently numbered an estimated 10,000 pairs in 1998.[46]

The numbers of salmon being consumed by Caspian terns and other birds are staggering: NMFS has estimated that in 1997, Caspian terns and cormorants consumed 10-30% of all juvenile fish entering the estuary, a figure that translates to between 9.2 and 30.1 million fish consumed.[47] The agency also estimated that anywhere from 420,000 to 2.5 million *listed endangered species* were estimated to have been eaten by Caspian terns in 1998.[48] Worse yet, the cormorant problem is not limited to the lower Columbia River. Cormorants are common throughout the FCRPS, with nesting colonies on many reservoirs including Potholes Reservoir near Moses Lake, Washington. Although there are no salmon in Potholes Reservoir, Cormorants has severely reduced the yellow perch population. Therefore, mortality figures for predation are likely underestimated, given that the study only concerned predation of fish entering the estuary.

The NMFS had previously anticipated the Caspian tern problem and included a requirement in the 1995 BiOp that the Army Corps of Engineers study ways to save the young salmon from their voracious appetite.[49] On November 22, 1998, the Army Corps of Engineers issued a Biological Assessment for the Caspian Tern Relocation Pilot Project (Tern Relocation Project),[50] and on January 15, 1999, issued the finding of no significant impact.[51]

The peak migration period of outward-bound juvenile smolt coincides perfectly with the nesting and rearing season of the Caspian terns located on Rice Island. Because the

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44. *See* 16 U.S.C. §§ 710-712 (1994). The roster of species protected under the MBTA can be perused at 50 C.F.R. § 10.13 (1998).
45. U.S. ARMY CORPS OF ENG'RS, CASPIAN TERN RELOCATION PILOT STUDY, LOWER COLUMBIA RIVER CLATSOP COUNTY, OREGON, ENVIRONMENTAL ASSESSMENT AS ATTACHED TO THE FINDING OF NO SIGNIFICANT IMPACT 3 (1999) [hereinafter 1999 FONSI].
46. *See id.*
47. CASPIAN TERN BIOP 3.
48. *See id.* at 12.
49. Incidental Take Provision number 9 in the 1995 BiOp stated:

> The COE shall conduct studies to identify (a) Caspian Tern predation of juvenile salmonids, and (b) methods to discourage tern nesting. The Caspian tern, *Sterna caspia*, population in the lower Columbia River has increased significantly. The tern colony at Rice Island (an island created by dredge material disposal by the COE) is the largest on the west coast of North America (Gill and Newaldt 1983). *The NMFS believes that this colony has the potential to consume large numbers of smolts each year*.

1995 BIOP at 162 (emphasis added).

50. *See* U.S. Army Corps of Eng'rs, Biological Assessment for Columbia River ESA Listed or Proposed Salmonid Stocks Caspian Tern Relocation Pilot Study Columbia River Clatsop County, Oregon (1998).
51. *See* 1999 FONSI.

estuary is the beginning of salt water intrusion into a fresh water environment, the acclimating young fish hover near the top of the river before entering the ocean and thus become prime candidates for avian predation.

And, in an ironic twist of federal environmental law, because Caspian terns are protected under the MBTA, this situation presents the bizarre sight of federally protected birds devouring millions of federally protected endangered species; all facilitated by manmade optimum tern nesting habitat.[52] The Caspian tern situation is symptomatic of the problem with predation because it presents the ironic spectacle of an immovable object meeting irresistible forces: the Endangered Species Act has collided with the Migratory Bird Treaty Act and Marine Mammal Protection Act to the detriment of salmon recovery in the Pacific Northwest.

In February of 2000, the State of Idaho submitted comments on the Draft Environmental Assessment for Caspian Tern Relocation. Idaho is on record that the Year 2000 program does not meet the need to protect threatened and endangered components of the Columbia River salmon runs. Generally, the state has proposed more urgent attention to salmon recovery as a bi-product of the Caspian tern relocation project, rather than an orientation towards overall bird management under the Migratory Bird Treaty Act.[53]

Recently, at the urging of environmentalists, a federal judge enjoined the key Caspian tern harassment component of the relocation project over the objections of Idaho, Oregon and Washington.[54] As a result, another spring migration season has taken place with young listed salmon being slaughtered by avian predation with the blessing of the courts.

The Plan and terms and conditions of the FCRPS BiOp call for *studies* to reduce bird predation at FCRPS dams and in the Columbia River estuary. It is unclear how merely funding projects to study the mechanisms of avian predation can help avoid jeopardy in the near term. The State of Idaho reluctantly conceded delay in 1999 and 2000 in order to complete research on bird predation and relocation. Although this research helped answer questions, it came at a high cost to migrating salmon smolts. This research knowledge must now be applied. The birds can be kept from nesting on Rice Island, and can be relocated to alternative sites. However, birds relocated downriver still consume far too many smolts. This knowledge should provide the basis for a plan to relocate the birds out of the estuary and lower river until salmon and steelhead populations rebuild.

The argument that relocating birds should be delayed until suitable bird sites are developed is not consistent with conservation needs of the fish. Avian and mammalian predator populations are currently robust in the Columbia River estuary, whereas many anadromous fish populations are imperiled. Deference must be given toward greater protection of these imperiled fish until populations are stabilized and begin rebuilding.

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52. *See* 1999 FONSI at 3 (noting that "several islands in the estuary being used for nesting … were created by dredging the navigational channel after the Mt. St. Helens eruption in 1980").
53. *See* Comments of the State of Idaho, February 18, 2000, *re* Public Notice CENWP-PM-E-00-02, Caspian Tern Relocation FY 2000 Management Plan & Pile Dike Modification, January 19, 2000.
54. National Audubon Society et al. v. Butler, No. C00-0615R (W.D. Wa.)(TRO granted April 10, 2000).

Once this occurs, the estuary ecosystem can be managed appropriately to accommodate fish, birds and mammals.

The immediate priority is to reduce bird predation on smolts to appropriate conservation levels. The data indicates that this cannot be done without removing nesting colonies from the estuary and lower river. This should be done immediately and concurrently with alternative site development for bird nesting at other coastal locations.

b) Pinnipeds

The NMFS, in accordance with Section 120(f) of the Marine Mammal Protection Act (MMPA), has detailed the results of scientific investigation into the impacts of California sea lion and Pacific harbor seal predation on salmonids and coastal ecosystems of Washington, Oregon and California.[55] The NMFS concluded that pinniped predation on migrating young salmon, especially at areas of restricted fish passage, can have negative impacts on recovery efforts.[56]

The NMFS identified two issues in the report, the first dealing with pinniped impacts on salmonids, and the second dealing with pinniped impacts on west coast ecosystems.[57] Addressing the issue of pinniped consumption of endangered species, the NMFS report concluded that the west coast populations of sea lions and harbor seals remain healthy and had increased at an average annual rate of five to eight percent a year since the Marine Mammal Protection Act (MMPA) passed in 1972.[58]

The report noted that the pinniped population had not conclusively reached its optimum sustainable population (OSP) level.[59] Until the seal and sea lion populations were demonstrated to be at the OSP level, management actions, such as waiver of the MMPA moratorium on taking marine mammals or transfer of management authority to the state for the effective resolution of many pinniped-fishery resource conflicts, cannot be taken under the MMPA."[60]

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55. NATIONAL MARINE FISHERIES SERV., REPORT TO CONGRESS: IMPACTS OF CALIFORNIA SEA LIONS AND PACIFIC HARBOR SEALS ON SALMONIDS AND WEST COAST ECOSYSTEMS 4 (1999) [hereinafter IMPACTS REPORT]. Congress authorized the report. *See* 16 U.S.C. § 1389(f).
56. For purposes of Northwest salmon recovery, the pinniped species of concern are the California sea lion and the Pacific harbor seal. *See* 16 U.S.C. § 1389(f) (1994) (directing the Secretary of Commerce to investigate "whether California sea lions and Pacific harbor seals . . . are having a significant negative impact on the recovery of salmonid fishery stocks").
57. The first issue, most pertinent to predator control was characterized as follows:

    California sea lion and Pacific harbor seal populations on the West Coast are increasing while many salmonid populations are decreasing. Salmonid populations that are depressed and declining, especially those that are listed, proposed to be listed, are candidates for listing under the ESA, can be negatively impacted by expanding pinniped populations and intended predation.

    IMPACTS REPORT at 2.
58. *See id.* at 2. The Marine Mammal Protection Act is located at 16 U.S.C. §§ 1361-1421 (1994).
59. IMPACTS REPORT at 2.
60. *See id.*

The NMFS report recommended a streamline approach for lethal removal of California sea lions and Pacific harbor seals where the species are impacting severely depleted salmonids.[61] The NMFS also called for continued review of effective non-lethal methods,[62] and, with respect to protection of commercial fisheries and their property, the statutory amendment to the MMPA authorizing the killing of certain pinnipeds as a last resort in order to protect the fishermen's gear or catch.[63]

In 1994, the MMPA was amended to allow states to request authority for lethal removal of certain protected pinnipeds to protect salmon populations.[64] The NMFS reports, however, that such a process has been perceived as "cumbersome and [states and other authorities] believe the amount of evidence needed to establish that specific pinnipeds are indeed having such an impact on a given salmonid population is exceedingly time-intensive, difficult, and expensive to obtain ... ."[65]

The MMPA has been spectacularly successful in protecting the object of its affection.[66] The statutory amendments suggested by the NMFS in its report should be enacted by Congress in order to provide greater flexibility to eliminate this type of mammal predation. The NMFS should thus expand its analysis of pinniped predation from the 1995 BiOp.[67]

California Sea Lions and Pacific Harbor Seals (Pinnipeds) have been identified by the Pacific States Marine Fisheries Commission (PSMFC), the Washington Department of Fish

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61. Specifically, the NMFS recommended that:

    1. in situations where California sea lions or Pacific harbor seals are preying on salmonids that are listed or are proposed or candidates for listing under the ESA, immediate use of lethal removal by state and federal resource agency officials would be authorized. . . .
    2. in situations where California sea lions or Pacific harbor seals are preying on salmonid populations of concern or are impeding passage of these populations during migration as adults or smolts, lethal takes by state or federal resource agency officials would be authorized if (a) non-lethal deterrence methods are under way and are not fully effective, or (b) non-lethal methods are not feasible in the particular situation or have proven ineffective in the past.
    3. in situations where California sea lions or Pacific harbor seals conflict with human activities, such as at fishery sites and marinas, lethal removal by state or federal resource agency officials would be authorized after non-lethal deterrence has been ineffective.

Id. at 14.

62. *See id.* at 15.
63. *See id.* at 15-16.
64. The MMPA was amended to afford the opportunity for a state to "apply to the Secretary to authorize the intentional lethal taking of individually identifiable pinnipeds which are having a significant negative impact on the decline or recovery of salmonid fishery stocks. . . ." 16 U.S.C. § 1389(b)(1).
65. IMPACTS REPORT at 9.
66. The 1995 BiOp called for continued studies of predator control aimed at .pikeminnow removal and reducing avian predation. *See* 1995 BiOp at 122.
67. *See* Comments of Governor Dirk Kempthorne to the Northwest Power Planning Council, Boise, Idaho (April 7, 1999) ("[T]he Marine Mammal Protection Act has been highly successful. Just this decade, we have seen a six-fold increase in the number of West Coast sea lions. When the Marine Mammal Protection Act was put in place, there were an estimated 7,000 sea lions. Today, there are close to 170,000.").

and Wildlife (WDFW), the Oregon Department of Fish and Game (ODFW) and California Department of Fish and Game (CDFG) as negatively impacting depressed and declining Salmonid populations.

The current populations of these pinnipeds may be larger than at any other time in the past several centuries. Although the population is now very large and may be greater than any time for which we have records, there is no evidence that it has reached its optimal sustainable population level, known at OSP, which is the management goal mandated by the MMPA. Management actions, based on the OSP, such as a waiver of the MMPA moratorium on taking marine mammals or transfer of management authority to the states for resolution of pinniped-fishery resource conflicts, are the primary alternatives offered.

Predation often occurs in areas where depressed, threatened or endangered populations of salmonids must pass to reach spawning areas as adults or the sea as smolts. Where salmonid passage conflicts have been adequately documented, such as at the Ballard Locks, there is sufficient evidence to show that pinnipeds can have a significant negative impact on a salmonid population.

Conflict between pinnipeds and salmonids have developed 128 miles upriver at Willamette Falls in Oregon City, Oregon. In 1995, observations revealed sea lions killing and consuming an average of one salmonid per hour. In 1996, during limited observations (155 hours) at least five sea lions were seen consuming 42 chinook, 27 steelhead, and 20 unidentified salmonids, amounting to about 0.6 salmonids per hour.[68] Non-lethal deterrents were tested by ODWF without success in 1996.

A 1992 study calculated that during the 100 days when adult Snake River spring chinook were migrating, 2,100 seals in the Columbia River consumed 15,700 salmon, of which 3,000 were Snake River chinook. A 1993 study estimated that harbor seals took 22,558 salmon of which 4,500 were assumed to be Snake River chinook.[69]

Scarring (tooth marks and claw rakes) is considered another indicator of pinniped predation pressure on salmonids. Studies conducted in 1990 at the Lower Granite Dam with 19% of examined Snake River spring chinook showing scarring, 1990 to 1993 showed 7.8% of the steelhead with scars and 16.4% of the spring/summer chinook. 1994 Bonneville Dam and several hatcheries on the Columbia and Snake Rivers found 24% of the steelhead with scarring and 16% of the spring chinook. Research suggests that pinniped-induced stress from scarring and injuries may also result in lowered spawning success and that considerable salmonid mortality, both direct and indirect, may result from confrontations with, and injuries from pinnipeds.

In many situations, pinnipeds are causing economic impacts of undetermined magnitude on both commercial and recreational fishing industries in Washington, Oregon and California. In the commercial fisheries, pinnipeds depredate catch and damage gear.

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68. NMFS February 10, 1999 Report to Congress.
69. The Northwest Salmon Recovery Report, January 18, 1999.

Commercial fishers lose income because they are unable to catch, land, and sell fish. Reductions in commercial landings result in economic loss to coastal communities. State agencies responsible for managing commercial fisheries lose revenue due to fewer commercial landings. This reduces funds available for monitoring, research and management of marine resources.

Predation by pinnipeds in recreational and commercial salmon fisheries reduces the accuracy of fishing mortality estimates. When pinnipeds remove a fish from a line (hook) or net, fishing mortality is effectively increased. Commercial fishers (operating under a quota or harvest guideline) and recreational anglers normally will continue fishing to replace those depredated fish. The full extent of current pinniped depredation is unknown.

The 1994 Amendments to the MMPA also impose a new prohibition on the intentional lethal take of pinnipeds by commercial fishers to protect catch and gear. The NMFS has had to focus marine mammal research on stock assessments because Sections 117 and 118 of the MMPA require current population size estimates for all marine mammal populations and estimates for fishing mortality in order to manage the incidental taking of marine mammals during commercial fishing operations.

The NMFS is given responsibility to regulate the use of living marine resources under a number of statutes: ESA, MMPA, and the Magnuson-Stevens Fishery Conservation and Management Act. Because there is no clear legislative guidance, conflict has arisen among these laws. For example; the conflict between the ESA and the MMPA regarding protection of listed species of salmon from predation by expanding pinniped populations.

The PSMFC and the States have characterized the authorization process as cumbersome and believe the amount of evidence needed to establish this point is exceedingly time-intensive, difficult and expensive to obtain. There is no provision in the MMPA to accommodate normal or expected uncertainties in the determinations; this reduces the ability of resource managers to enhance biodiversity in the affected system by protecting listed salmonids.

c) Northern Pike minnow

A recent study has estimated that approximately 16.4 million juvenile fish, or eight percent of all downstream migrants, were consumed annually by the northern pike minnow [or squawfish] prior to 1990. The northern pike minnow are a long-lived native fish species that pray upon young migrating salmonids.

As a result of this significant predation of the juvenile salmon, the Northern Pike Minnow Management Program (NPMP) was fully implemented in 1991. The program consists of three components: 1) a sports fishery where public catches of the predator fish are rewarded; 2) a state agency fishery where personnel are hired to remove the northern pike minnow from dams or in boats around the dams; and 3) gill-net fisheries at specific locations where high levels of predation may occur. The PSMFC, the Washington Department of Fish and Wildlife, and the Columbia River Inter-Tribal Fish Commission are the entities with operational responsibilities for the program, and the ODFW has evaluation responsibility. The total annual budget for the program is estimated at $3 million annually as funded through BPA. Idaho supports the continuation of the NPMP. The program has proven effective in reducing predation by the northern pike minnow and is well justified.

NMFS has also overlooked competition and predation from non-indigenous species such as carp and warmwater gamefish. An aggressive program to remove bag limits and seasons, as well as programs to reduce warmwater gamefish populations is necessary. Similarly, an aggressive program to reduce carp populations, either through management actions or encouraging commercial harvest of carp is needed.

5. Water Quality

In 1972, Congress, passed the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act or CWA), which set a goal of assuring that all rivers, lakes and streams in the country are fishable and swimmable. The CWA affords individual states, through their own statutes and programs, the opportunity to assume the responsibility of implementing it.

To measure progress toward meeting the "fishable, swimmable" goal, the Clean Water Act mandates that all waters of the state be designated for beneficial uses and then standards be adopted which are sufficient to protect those beneficial uses. Idaho law requires the designation of beneficial uses as well as protection of existing uses and water quality.

Currently, the beneficial uses that might either exist for streams in Idaho or which might be designated for them include aquatic life, recreation, public water supplies, wildlife and aesthetics. Criteria that recognizes the needs of individual species is also provided. For example, a specific temperature criterion to protect bull trout spawning is included in the state's water quality standards and is applicable if bull trout spawn in a stream.

a) Monitoring To Know Beneficial Uses Are Protected

Idaho's Department of Environmental Quality has developed a sophisticated method of "rapid biomonitoring," which shows the close correlation of biological and physical conditions in a body of water and the kinds and amounts of aquatic life found there.

In addition to the measures described in the law, Idaho scientists have also incorporated determination of macro invertebrate organisms (aquatic insects) along with analysis of algae species as indicators of stream conditions. The methods now employed in Idaho are similar to those used in at least three-quarters of the other 49 states where water quality personnel have also found that biomonitoring gives a better evaluation of human impacts on water quality than merely measuring chemical and physical parameters.

Since 1993, the IDEQ has relied upon biomonitoring as initially developed for Idaho by scientists at Idaho State University to determine the level of support for beneficial uses in each water body of the state. Each year the IDEQ hires and trains field crews who spend the summer months collecting water quality and biological data for a portion of streams in each of Idaho's six major river basins. This data is reported to IDEQ's regional offices and checked for accuracy.

b) Land Uses and Water Quality Standards

The discussion above applies to all bodies of water in the state, regardless of who owns the land through which the water may flow or the purpose for which that land may be used. However, different land uses have varying impacts on water quality, ranging from the concentrated impacts of urban development or irrigation of row crops to the very limited human impacts in streams flowing through undisturbed forests. This relationship between land uses and water quality is important in the discussion of salmon habitat, because many of the streams in which salmon spawn in Idaho flow through forestlands with few uses that serve as a serious pollution source.

Except in rare instances, streams in wilderness or roadless lands should be fully supporting their beneficial uses, since there likely have been virtually no human activities in those areas that would have altered the natural condition of the water.

Further, even if a stream did not fully support its beneficial uses as the result of a natural event like a fire, landslide, or a flood, the limitations on access to it would likely preclude any effort by humans to aid in restoration. Accordingly, for the miles of salmon spawning habitat in either wilderness or flowing through roadless lands, regulatory actions by the state may be irrelevant.

Idaho's economy has traditionally been heavily dependent on agriculture and natural resource industries. In recent years, as the economy has diversified and population grew, the economy of the vast majority of Idaho's rural communities remained a product of activities that can contribute to water quality problems. Logging, grazing, mining and intensive row-crop agriculture has characterized the state since settlement, and these human efforts have had their impacts.

Since the passage of the federal Clean Water Act and the subsequent state programs to implement it, great strides have been made to protect water bodies from the impacts of mostly non-point sources of pollution. The legal basis for this progress is found in the "antidegradation" requirements of the federal law and subsequently reflected in Idaho law. This section provides that even though water quality may be lowered to accommodate important economic or social development in no case can the quality be allowed to fall below the standard of full support of the existing beneficial uses. Since most activities within drainages that support or can support the beneficial use of salmonid spawning are non-point in nature, special attention must be given to the application of these statutory requirements to those non-point sources of pollution.

Idaho's water quality standards spell out the functional tie between statutory requirements and how logging, mining, agriculture, construction and all other activities not subject to point source permits must be carried out. "Best management practices" (BMPs), are the on-the-ground methods deployed to prevent runoff from non-point activities.[70] They are requested to be designed, implemented and maintained to provide full protection

70. IDAHO ADMINISTRATIVE CODE § 20.02.01.05, IDAPA.

or maintenance of beneficial uses. If these measures are judged to be ineffective, then the practices will be evaluated and modified as necessary by the appropriate agencies. The agencies referenced here are specific units of government statutorily charged with developing best management practices for the non-point activities with which they have familiarity and enforcement authorities if the BMPs are not followed.

This is the concept of the "feedback loop" for maintaining and protecting water quality. In essence, this concept focuses on prevention of pollution before it happens, as opposed to levying fines and other legal sanctions after the pollutant has entered the stream.

While IDEQ and other designated agencies have the ability to enjoin non-point activities that are having an immediate detrimental effect on water quality, the clear emphasis is prevention by regular monitoring to assure the best management practices are working.

c) Idaho's TMDL Process

For violations that cause an imminent and substantial threat to public health or the environment, the IDEQ may seek immediate injunctive relief. Where there is either a discharge of water that exceeds the levels specified in a point source permit or where BMPs are not being followed, the situation must immediately be corrected. However, most water bodies where the beneficial uses are not fully supported have as the cause a series of "legacy" sources of pollution or habitat modification, the vast majority of which originated long before the Clean Water Act took effect.

For these situations, other methods are necessary to restore the quality of the water body so that, once again, the general standard of full support of the beneficial uses is met. One key method is the total maximum daily load, or TMDL.

Even though it was enacted before EPA proposed its most recent guidance for completing TMDLs, Idaho's law mirrored the federal requirements. As required by section 303(d) of the Clean Water Act, Idaho statute mandates that the IDEQ identify water bodies that do not meet water quality standards or fully support the beneficial uses, and then once identified the director is required to develop a total daily load to control point source and non-point sources of pollution on the water body. The TMDLs are required to identify the pollutants, inventory of their sources, develop pollution control strategies, and estimate of how long it will take to once again achieve full support of the beneficial uses.

In 1990, two environmental groups sued EPA, as other groups had done in several other states. The environmental group plaintiffs argued that EPA and IDEQ were delinquent in meeting the requirements of the Clean Water Act for identifying water bodies in Idaho not meeting standards and then developing TMDLs to correct the situation. As a result of this litigation, Idaho is now completing TMDLs on a court-ordered schedule.

The original schedule was based on a list of "water quality limited" streams prepared by EPA pursuant to federal litigation. Gradually, this original list is being modified and streams dropped as IDEQ determines that their beneficial uses are, in fact, fully supported. Others are added when monitoring shows something less than full support status.

Some of the efforts are directed at streams in which salmonid spawning is an existing or a designated beneficial use. For example, in September of 1999, IDEQ completed the Lochsa River Subbasin Assessment. This drainage, which is completely anadromous, includes a number of streams that were on the original 1992 303(d) list. Since then, however, monitoring has shown that all the streams in the basin fully support the beneficial use of "salmonid spawning", and none will be included on the 2000 303(d) list of streams not meeting standards. This also means that there is no need for further efforts to develop a TMDL for this hydrologic unit code, or "HUC."

Idaho was one of the first states to enact legislation to protect water quality from the effects of logging after initial passage of the federal Clean Water Act in 1972. In 1976, administrative rules were approved and the Idaho Department of Lands began to enforce them. Under the water quality standards, the IDEQ may utilize applicable analytical procedure to determine whether all the applicable water quality standards are being achieved. [71]

The same rule specifies that the Department shall evaluate such biological and habitat parameters such as stream width, depth, and shade, sediment, bank stability, and flows. Biological parameters may include: evaluation of aquatic macro invertebrates and the variety and number of fish and other aquatic life to determine the diversity and functionality of the biological community. [72]

In using these parameters to assess the status of the beneficial uses, the Department has chosen to examine the streams of the state in a systematic, watershed-based manner. As a result of this approach and the schedule for the TMDLs, the Department has divided state's major river basins into 84 HUCs and set forth a schedule for TMDLs to be completed in all impaired basins in the watershed. *See* Exhibit I.

Exhibit J indicates that of the 30,665 miles of streams potentially available to anadromous fish, 17,518 miles or stream (57%) are either in roadless, wilderness or in areas with a completed TMDL. This means essentially no additional regulatory measures are either needed or possible.

Each year, the Department focuses its beneficial use reconnaissance program (BURP) monitoring on the water bodies within the HUCs for which TMDLs are next scheduled. From this monitoring, IDEQ updates the list of water bodies that should be included in the TMDL by deleting from the list those where beneficial uses are now found to be fully supporting and adding streams where they are not.

Additional examples of successful TMDL processing are set forth below.

71. *Id.* § 58.01.02.053, IDAPA.
72. *Id.* § 58.01.02.053.02, IDAPA.

(1) The Main Salmon River-Chamberlain Assessment—Monitoring for Beneficial Use Attainment and a Precursor to a TMDL

In December of 1999, IDEQ released a review draft of the Main Salmon River-Chamberlain Subbasin Assessment. From a salmon recovery standpoint, this is an important drainage, since it contains a number of important spawning streams. It also represents a variety of land uses and classifications and contains pristine streams where standards are clearly met as well as those that may not fully support beneficial uses.

A portion of the assessment is devoted to describing the land ownership, land uses and classifications, the geology of the area and climatological and topographical features of the area that might have a bearing on the ambient water quality of the streams within the area. The Forest Service manages most of the land and much of it is either within designated wilderness areas or is roadless. There is a history of mining, grazing and limited timber harvesting in the basin.

Eight stream segments were listed as "water quality limited" (i.e., not fully supporting the beneficial uses) in 1996. Seven of these streams are in the vicinity of Dixie and between the Frank Church and Gospel-Hump Wilderness boundaries and are listed for excessive sediment. Warren Creek on the south side of the Salmon River is listed for "habitat alteration" and the Salmon River itself from Corn Creek to Cherry Creek was on the list for unspecified pollutants.

In 1997, IDEQ completed beneficial use reconnaissance monitoring on three streams within the subbasin. In addition, the Department relied upon extensive monitoring efforts by the Nez Perce National Forest staff for information on the most impacted areas. Their assessments included monitoring of streams flowing through active timber sales as well as streams severely impacted by placer mining in past years.

According to the assessment, BURP samples confirm that they are properly 303(d) listed. Similarly, macroinvertebrate studies along with the monitoring data presented by the Forest Service confirmed the continuing legacy impacts of mining, timber harvests, and, more recently, residential development around the town of Dixie.

The result of the assessment is two-fold. First, some streams like the main Salmon River, many of which were placed on the 1996 303(d) list without any scientific evidence of water quality problems, will be taken off the list to be submitted in 2000. Others, including Crooked Creek will remain on the list and be addressed in an upcoming TMDL.

However, all indicators point toward a fairly pristine overall subbasin—probably one of the most pristine in the state, and that there are identified areas where intense development in the form of mining, grazing, road construction, residential and recreational building, and timber harvesting have taken place leading to localized water quality impacts.

(2) Jim Ford Creek—Restoring Salmon Spawning Through a TMDL

In November of 1999, IDEQ completed the draft TMDL for Jim Ford Creek, located in Clearwater County near the town of Weippe. This relatively short (20 miles) stream is representative of the many issues and the complexity of restoring water quality when the beneficial uses are not fully supported. First, there is no single large and ongoing source of pollution that is impairing the beneficial uses. Rather, impacts to the stream have accumulated over time and from many sources including forestry, grazing, two water treatment plants, land development and urbanization and a hydropower development.

Second, the myriad of land uses and corresponding impacts to the water body, coupled with a number of land ownerships and regulatory jurisdictions, would imply an inefficient process for allocating the amounts of pollution and then for developing a plan to restore the biological integrity of the watershed. This multiplicity of jurisdictions and land ownerships is reflected in the number of efforts to assess the quality of the stream.

Between the IDEQ and the Nez Perce Tribe, there have been five separate BURP surveys. Apart from those, about 15 various other efforts can be documented to assess either some aspect of the quality of Jim Ford Creek or the aquatic habitat it provides.

The stream has appeared on the list since 1992, with pollutants of sediment, excessive temperatures, pathogens, nutrients, low dissolved oxygen, ammonia, oil and grease, habitat modification and flow. The goal of the TMDL is to establish a cold water biota in the upper reaches and "salmonid spawning" in the lower fourteen miles upstream from its confluence with the Clearwater River. The objective of the TMDL is to restore a degraded stream to a level of water quality that will, once again, support these beneficial uses.

For the salmonid spawning, two measures of water quality in the lower reaches of the stream stand out as limiting this beneficial use. The first is sediment, particularly the large "bedload" sediment that is filling pools and reducing the depth of the stream. The second is temperature, with summer water temperatures normally exceeding the upper limits for salmonid spawning. The other pollutants for which this stream is listed are not thought to be limiting to the salmonid spawning beneficial use.

Currently, the center of the stream is shallow because of the bedload sediment deposited in it. Stream flow is dispersed on either side, causing the stream to divide into a number of smaller streams and become "braided." In addition, bedload sediment has filled the normal pools so that most of them are half-filled with coarse sediment.

Correcting this problem will be one goal of the implementation phase of this TMDL. Toward that end, the Idaho Department of Lands and Potlatch Corporation, which collectively own 70 percent of the watershed, are completing a detailed evaluation of sediment sources so that specific allocations to watersheds and land uses can be completed.

Excessive temperatures are more easily addressed. Under the best of conditions, Jim Ford Creek is naturally warm. The upper reach flows slowly through a natural meadow and probably never has had much direct shade. The lower reach flows through a basalt canyon with rocks that radiate heat throughout the hot days and nights of summer.

Phase one of this TMDL, now essentially complete, includes identification of pollution sources and their relative contribution by source, along with reduction targets to be met. Phase two will focus on implementing the changes necessary in land uses and permitted discharges necessary to meet these targets. Phase two will also include monitoring to assure that trends in water quality are improving and to allow enforcement of those changes necessary to achieve positive trends.

Implementation of the Jim Ford Creek TMDL warrants practical consideration. First, positive changes will take time. The current of Jim Ford Creek is the product of many impacts accumulating over at least 130 years. While it will not take that long to restore the stream, human actions to plant trees or modify grazing practices can speed the process.

Second, improvements in temperature or reductions in sediment, do not, alone, assure a stream attractive to fish. Other factors, such as large woody debris in the stream or a stream bottom conducive to spawning, are equally important for salmonid spawning and are physical factors inherent to the stream which the TMDL cannot address.

d) Water Temperature

In the FCRPS BiOp and through regional water quality plans, EPA and state water quality agencies are trying to implement water temperature standards that were not met naturally before installation of the FCRPS. The 19 degree Celsius (64 degrees Fahrenheit) or 20 degrees Celsius (68 degrees Fahrenheit) standards EPA set were never applicable in the Columbia Basin because they were not met in nature before the hydrosystem was in place. As reported in a recent letter to the editor of the Walla Walla Bulletin, Livingston Stone in his report to the Commissioner of Fisheries in 1876 reported temperatures over 70 degrees Fahrenheit near the mouth of the Columbia River. Similar temperatures have been reported this year. It will be nearly impossible to meet current water temperature standards.

Instead of litigation, EPA and the states need to work together in setting reasonable standards. According to a study conducted for the Governor's Office by IRZ Consulting, water temperatures in some of the most pristine watersheds exceed the 64 degree Fahrenheit standards set by EPA, often reaching the mid 70's. Accordingly, the State and EPA should cooperate in setting reasonable standards.

However, the approach to analyzing temperature should be basin wide utilizing a collaborated effort that involves the state authorities, water users, and the regulated community. Simply focusing on the Snake River to Brownlee dam is inadequate. Summer temperature data of major tributaries of the Snake River reveal temperatures similar to those measured in the lower Snake River. Thus, it is incumbent upon the regulatory agencies to take a holistic, methodological approach in analyzing temperatures in the Basin. Studies are necessary to determine desirable, realistic and achievable temperatures for the Basin. Modeling is a useful tool for determining temperature standards. Unfortunately, the temperature model developed and currently used by EPA has significant technical deficiencies. Therefore, model modifications should be developed utilizing sound science.

Once this is achieved and reasonable state standards set, a state implementation plan should then be implemented.

e) Integrated Rule Curves

Integrated Rule Curves (IRCs) are a managed tool to optimize beneficial uses of flood control, irrigation, recreation, water quality and quantity, resident fish and wildlife and anadromous fish. Idaho supports the development of IRCs for operations at Dworshak and other appropriate reservoirs. Consideration of feasibility and benefits and risks associated with modifying Upper Snake River Canyon releases for allocation of water for springtime migrants are an important part of IRC development.

6. Land Management Practices

As the components of anadromous fish recovery in the Pacific Northwest are assembled, it is clear that the optimum habitat conditions throughout the region will play an important role in any successful strategy. The tools utilized to assess habitat conditions will guide policy makers in making necessary, important choices.

The federal agencies have employed several models to evaluate management actions on federal lands in the Columbia River Basin. The work done with the Interior Columbia Basin Ecosystem Management Project (ICBEMP) is to be the primary tool for federal land management decisions in the near future. To this date the United States Forest Service (USFS) and the Bureau of Land Management (BLM) have managed timber harvest, grazing, road construction, as well as mining and recreation through standards developed through the PACFISH and INFISH models.

Idaho is skeptical that these analytical tools, as models to be applied throughout the Columbia River Basin, are scientifically sound for such broad application. The State supports the Idaho Forest Practices Act as the foundation for public land management decisions.

Initially, it appears that ICBEMP data collection was intentionally biased toward coverage of federal lands because of its federal land planning objectives and legal sufficiency requirements of the National Forest Management Act (NFMA) and the National Environmental Policy Act (NEPA). Accordingly, its utility outside of federal lands is limited.

Secondly, the data assembled by the ICBEMP process lacks the quality assurance of a data validation process. This is particularly true for data derived from remote sensing sources, surrogate data that substitute for desired but unavailable data, composite indexes that are derived from multiple sources, and descriptions of historical conditions. Also, the forecasting tools have produced data of unknown validity. Accordingly, the ICBEMP data are of unknown quality.

Eventual data verification will be challenged by the limited availability of appropriate independent data sets, which are handicapped by limited geographic coverage and inconsistencies among the various potential sources that prevent aggregation and disaggregation. Furthermore, many of the disparate potential data sources lack validation themselves.

In most cases, the accuracy of ICBEMP data is uncertain. The ICBEMP administrative record contained entries pointing to significant deficiencies in the accuracy of the ICBEMP's broad-scale data. For example, the ICBEMP's vegetation data lack information on forest canopy closure, which determines many important ecological functions. Additionally, the integrity of data potentially is undermined when natural resource information, such as "ecosystem integrity" values, is based on convenient or readily available substitute data instead of actual data.

For example, road density is used as a surrogate for watershed integrity and impact to aquatic systems. Also, road density and area of timber harvest are used as surrogates for the amount of ecosystem degradation. Those assumptions indicate ICBEMP's bias for active federal land management.

There are also major shortcomings in the ICBEMP's data describing historical ranges of variability (HRV). First, very little data exist for the period prior to the 1930s, and much less for the period prior to 1900. Second, retrospective projections of ecological change performed by the ICBEMP to predict historical conditions are unverifiable. Third, "estimated mid-points" for HRVs are provided without the corresponding variability ranges.

The ability of the ICBEMP data to accurately estimate resource conditions, such as timber harvest acres and volumes, is severely limited. The landscape descriptions will have limited utility when high resolution or spatial specificity is required. The ICBEMP data set thus has serious limitations in resolution when applied spatially to finer scales of management.

A potentially serious inconsistency exists between the ICBEMP's broad-scale assessment and the fine-scale data needs of resource managers for planning and implementing ecosystem restoration and recovery projects and programs. The inconsistency results from varying classification systems, sampling methods, and inventory procedures. According to federal land management planners, vegetation classifications vary among administrative units and no decision on a consistent classification has been reached. The ICBEMP vegetation classification differs from the ones used on many national forests.

In its actions and decisions, the ICBEMP has made it clear that more accurate, fine-scale resource inventories, characterizations, and interpretations will be needed at finer scales of assessment prior to actual on-the-ground management decisions and activities. Fine-scale assessments of resource conditions and management opportunities will need to be based on a type and accuracy of data that is beyond what the ICBEMP produced. Therefore, ICBEMP is not reliable in analyzing smaller scale assessments and should not be used for site-specific assessments.

Unfortunately, there is potential for planners and managers to misapply the ICBEMP data if used out of context. This is particularly true now that Idaho's habitat has been dramatically effected by wildfires during the summer of 2000. These fires highlight the need for ICBEMP to evaluate wildfire risks associated with build up which it does not adequately do at the present. ICBEMP broad-scale data should not be used to directly or indirectly modify ecological output expectations during fine-scale planning without adequate analysis and verification. For example, an assessment of potential road-related adverse effects should be based on actual, verified local data, not extrapolated broad-scale road inventory data.

Fine-scale assessments will be needed to fully evaluate the environmental consequences of proposed resource management alternatives and to focus future management direction, independent of the ICBEMP. Again, the validity of the broad-scale ICBEMP data is questionable because they were not rigorously validated by fine-scale data.

Finally, a process for resolving data conflicts among inventory and planning scales is needed, based on accurate and spatially-specific data. It is important that the public and decision makers do not assume that the ICBEMP data are appropriate for use in any future decisions beyond its broad-scale, programmatic federal land management planning process.

a) PACFISH and INFISH

For the past two decades, improved management practices mindful of riparian and aquatic ecosystems have been in effect for both federal and non-federal forest ownerships. These improved approaches have been both voluntary and mandated by various laws. However, there is wide spread belief that forest management has led to the decline of native fish stocks and, consequently, believe greater protection in the form of less active management will restore declining stocks. This is the perception which led to the development by the USFS and BLM of the PACFISH/INFISH interim strategy. The State is mindful that PACFISH/INFISH is slated to be replaced by the ICBEMP process. However, to the extent that concepts initially developed in PACFISH/INFISH are relevant to ICBEMP, they are worthy of discussion.

Significant constituencies within the informed public and scientific communities do not support the PACFISH/INFISH interim strategy. Primarily, the PACFISH/INFISH interim strategy does not account for inherent uniqueness and variability among streams and riparian areas. This limits the ability of interim management strategies to provide healthy, sustainable aquatic and riparian ecosystems.

The PACFISH/INFISH interim strategy relies on criteria that ignore the fundamental principles of ecosystem management. It fails to recognize dynamic ecosystem processes and incorrectly assumes that a passive management approach will lead to healthy ecosystems. Riparian systems will not achieve proposed desired future conditions with the hands-off approach represented by PACFISH/INFISH.

Procedurally, PACFISH/INFISH requires strict adherence to rules that provide little flexibility, and empowerment to local managers which discourages adaptation to local conditions, opportunities and needs. This has significant implications for management of vegetation, control of wildfire, and ecosystem management throughout watersheds, and perhaps particularly in steep headwater areas where riparian areas may be most susceptible to catastrophic effects of unnaturally severe wildfire.

The State is concerned that the PACFISH/INFISH interim strategy results in an inordinate amount of designated riparian preserve and severely constrain active management activities to restore and maintain forest ecosystem health. This is problematic because forest restoration activities will be difficult to achieve if significant portions of watersheds are set aside in preserves imposed by riparian buffers.

Additionally, it is unknown what the effect will be on already declining forest health from setting aside such a large amount of resource from actions that would reduce potentially catastrophic risks to aquatic functions and processes. Finally, the social and economic effects of essentially removing such large and highly productive areas from the available timber supply base have yet to be appropriately factored into this decision making.

The interim PACFISH/INFISH criteria represent default, one-size-fits-all approach. These criteria are arguably without the best scientific basis available, and they do not reflect the dynamic, disturbance-based processes that naturally occur in riparian systems. The criteria are intended to reduce management-related risks in the absence of complete local knowledge of riparian and aquatic conditions. Ironically, these criteria do little to reduce potentially devastating wildfire risks or restore desirable ecosystem processes within riparian areas to more predictable or sustainable outcomes because they limit many types of management actions.

The designation of large riparian area set-asides ignores dynamic ecosystem principles that apply to riparian areas, and will likely impede active management to reduce wildfire hazards and forest health problems. In some naturally and unnaturally existing riparian communities, large area set asides preclude treatments necessary to restore natural functions and processes. Such restrictions probably will interfere with achievement of desired ranges of future conditions for federally managed land, including those for riparian areas as well as the affected up slope forest resources.

Alternative approaches to the PACFISH/INFISH interim strategy that are more scientifically based, adaptable at the local level, and are more in line with ecosystem management principles are needed to improve habitat conditions for native fish stocks throughout the forests of the Columbia River Basin.

b) The Idaho Forest Practices Act

In 1974, the Idaho Legislature passed a Forest Practices Act (FPA), IDAHO CODE §§ 38-1301 – 1313, to encourage Forest Practices that enhance social and economic benefits, "maintain forest tree species, soil, air and water resources, and … provid[e] … habitat for wildlife and aquatic life."

The FPA applies to all forest land in Idaho and regulates tree harvesting, road construction and reconstruction, reforestation, use of chemicals and fertilizers and slashing management. Administrative rules support the act, and establish minimum standards (BMPs) for all forest practices.

BMPs are enforceable through Notices of Violation (NOV), Cease and Repair Orders, and Stop Work Orders, as well as lien authority on real and personal property. In addition, the state will not accept a Forest Practices Notification from any operator with an outstanding violation, can impose prior bonding requirements on habitual violators, and can pursue misdemeanor charges.

Operations are subject to regular field inspections. Forest practices on state land are inspected at least weekly during periods of operation. Practices on private land are inspected as appropriate based on proximity to streams, stability of slopes, size of operation, and history of operator. Between 1988 and 1998, more than 32,000 inspections were conducted on a total of 48,000 private forest practices.

During the same period (1988 – 1998) the number of NOVs issued declined 25%. Annual implementation and effectiveness audits, conducted by IDL, and quadrennial audits, conducted by IDEQ, confirm this improving trend. Compliance with minimum standards since 1984 based on IDEQ audits is:

	1988	1992	1996
Federal	94%	93%	100%
State	97%	96%	98%
Industrial Private	95%	94%	95%
Non-Industrial Private	86%	89%	93%
TOTAL:	93%	92%	97%

When implemented, BMPs have consistently been 99% effective in protecting water quality across all ownerships. Results of audits have provided the basis for changes and improvements in the FPA rules since their inception. These include increased stream protection widths, culvert sizing, restrictions on equipment near streams and on steep slopes, and recruitment of large woody debris.

The FPA includes a Cumulative Watershed Effects (CWE) assessment process. To date, more than 100 watersheds, water quality limited as well as key bull trout watersheds, have been assessed. The 1999 legislature increased funding for this important program, which is designed to identify adverse conditions in a watershed, and to design measures to correct those conditions.

There are numerous examples of rule changes to make the law more effective. Prior to 1996, Idaho Forest Practices Act rules required that 15 feet of generally undisturbed vegetation be left along "class II" streams, which streams are intermittent and generally do not support continuing fish populations.

As part of the regulations requiring water quality monitoring and surveillance of nonpoint activities used to evaluate the effectiveness of best management practices in protecting beneficial uses, a team of forestry, fisheries and water quality specialists regularly examine forestry practices. They do this by making field visits to 25 randomly selected timber sales every four years, walking over the sites and determining, first, if the BMPs were followed and, second, were they effective in preventing reductions in water quality.

After having visited a number of these sites, the team began to see a consistent pattern. Even though the BMP requiring a 15-foot buffer on each side of class II streams was followed, sediment from the disturbed area still often entered the stream. There was no need for sophisticated monitoring to decide this. In each case, a small rivulet cut through the leaves and other litter on the ground surface and left a clearly visible trail of sediment that ended in the stream itself.

While one such incident would probably not call for a change in the rules, a number of them clearly do. As a result of their observations, the team, through the Department of Lands, petitioned the Board of Land Commissioners for a change in the rule to require that wider buffers be left on these streams. In 1994, the Board initiated rulemaking to do this, with public hearings across the state. In 1996, the Board adopted the new rule, and the Forest Practices Act BMPs now require thirty-foot buffers along class II streams.

Forestland owner assessments and general tax revenues fund the FPA. It is an effective, practical means of allowing continued forest practices that support Idaho jobs and economy, while protecting the multiple benefits of the forest environment. It is a balanced program of education, inspection, and enforcement, is supported by Idaho residents, and is dynamic, based on scientific data.

7. Estuary Conditions

The estuary environment is vital to the survival and recovery of all Columbia River salmon and steelhead, including ESA-listed Snake River fish. The estuary provides an important transition between fresh and salt water. Year-class strength is often determined during estuary and early ocean residence. Estuarine conditions are likely to affect all species, races and stocks of Columbia River Basin salmon and steelhead, and thus must be a primary focus of conservation and recovery efforts.

The effects of mortality in the marine environment are often at least an order of magnitude more important on adult returns than the same change in mortality in the freshwater part of the salmon's life cycle. There is a growing body of scientific evidence that marine conditions (like freshwater conditions) have been declining over the past century.

For this reason it would be prudent to assume that the mean marine survival is declining, but that short-term cycles around that mean remain. Further, it is not a reasonable assumption that salmon can adapt to these rapid changes. The evidence shows that salmon have not adapted to deteriorating marine conditions during the entire 20th Century.

Any serious effort to rebuild anadromous fish runs in the Columbia River Basin must focus on all life history of salmonids and identify all opportunities to improve gravel-to-gravel survival.

To date there has been a major focus on survival during upstream and downstream passage through the hydropower corridor, and to a lesser extent on anthropogenic effects. This focus remains narrow despite growing evidence that survival of smolts as they pass through the hydropower corridor may be higher than previously thought and approach pre-dam levels.

The foregoing should cause concern and point to the need to broaden the approach to salmon enhancement to include focus on poorly-understood periods of the salmon life-cycle. These include the periods during migration through the lower Columbia River (downstream from Bonneville Dam), the estuary and adjacent nearshore ocean, and the Northeast Pacific Ocean. This is not to say that efforts to improve inriver migration conditions should be de-emphasized.

Although at first glance the opportunities to influence events and processes in the estuary, nearshore ocean, and the more-distant ocean appear limited, it is essential to understand the ecological linkages in these environs and how they work to shape survival and year-class strength. Such understanding will permit managers to better interpret success or failure of adult returns in relation to events in the freshwater phase of the salmon's life cycle. For example, survival improvements to spawning and rearing habitat, or altered hatchery practices, may be impossible to demonstrate if nearshore ocean conditions are so unfavorable that few fish survive.

Moreover, results of certain types of paired comparisons in the migration corridor may be obscured by differences in timing of arrival in the estuary and subsequent saltwater transition. Finally, more precise knowledge of processes and mechanisms that shape population dynamics in the estuary and nearshore ocean are essential to developing mechanistic models that have relevance to overall harvest management.

Large and broad scale declines in marine survival of salmon have occurred from Oregon to south-central British Columbia coastal waters. In at least some stocks, the changes in ocean survival dwarf the changes observed in freshwater survival. Without understanding the causes of reduced ocean survival and the stocks that are primarily affected, initiatives to restore salmon populations by improving freshwater habitat may be compromised.

Changes in marine survival appear to be related to sudden shifts in the climate of the ocean and atmosphere. These climate changes appear to have been intensifying (and worsening) since the 1960s for more southern populations including Oregon. The ocean survival of Oregon coastal coho salmon (no dams) has decreased in the 1990s to $1/10^{th}$ of the survival experienced in the 1960s. In British Columbia, many southern stocks of coho, chinook, and steelhead have also seen ocean survival decrease sharply since 1990, bringing some stocks to the verge of extinction in less than a decade.

Additionally, ocean-condition affected mortality may overwhelm the effects of any action taken in the fresh water portion of the salmon's life cycle, resulting in misinterpretation of the effects of management actions taken in the hydro corridor or Basin tributary streams.

To emphasize this relationship its important to understand that if survival in the ocean is on the order of 3%, a one to two percent change in survival will be reflected in a 30 to 60% change in adult returns. However, when in river survival during smolt outmigration to the ocean is of the order of 50%, a one to two percent change in freshwater survival will produce only a 2 – 3% change in adult returns.

Marine mortality estimates for Columbia River Basin salmon are limited, but Canadian and Alaskan researchers have recognized the importance of this information. The issue here is not that one can use mortality from another population or species and assume similar mortality for Columbia Basin stocks, but that there is substantial variability in marine survival for salmon.[73]

A preliminary NMFS analysis of chinook release and smolt-to-adult return (SAR) data shows that SAR's can vary by at least an order of magnitude for fish released just a few days apart. One study contrasted the climatic shift affecting steelhead around 1990 with the 1977 shift. The 1977 shift affected all areas of British Columbia similarly, while the 1990 shift had a different effect depending upon the region of the coastal ocean juvenile steelhead entered. While the NMFS analysis is preliminary, that analysis and other research suggests there are substantial differences in marine survival over release periods on the order of days and over space on the order of several km.

The reasons for the change in ocean survival are poorly understood, in part because salmon from Washington and Oregon have been affected most severely, while salmon from Alaskan stocks have experienced improved ocean survival until recently. Focusing future restoration efforts more explicitly on stocks whose migratory behavior moves them rapidly out of regions of poor survival might improve the overall success of such efforts.

It is important to move forward on identifying the relative impact of changes in marine survival because of the need to correctly identify what is currently causing reduced salmon productivity. In addition, events happening in the ocean are also linked to the freshwater habitat - low survival in the ocean leads to reduced escapement, which in turn leads to depressed nutrient input to freshwater from salmon carcasses, as well as genetic changes to the stock. These can in turn lead to further reductions in ocean survival because of lower future fitness of the smolts as they leave freshwater for the ocean- a downward spiral.

The most important contribution that ocean research will make is to inform public policy—by identifying conditions that are leading to worsening ocean habitat for salmon, by focusing scientific and public attention on the enormous changes in ocean survival relative to freshwater survival that have already happened, and by providing a baseline of information by which to gauge how much worse ocean conditions for salmon could become if the climate continues to deteriorate. The baseline data necessary to assess these issues needs to be collected before informed assessment is possible.

73. The risks in not highlighting this variability need to be considered. Welch (1998) calculated the average marine survival of Oregon coastal coho for three regime periods of 1960-77 (6.1%), 1978-90 (3.3%), and 1991-95 (0.5%). Survival in 1991 and later years declined to an average less than 1/5th the rate evident in the 1977-1990 period, and only 1/10th that of the period prior to 1977. The magnitude of these changes is more striking when one considers that there are no effects of "extra" or "delayed" mortality from a hydro system. Similar figures are available for Keogh River (B.C.) steelhead.

8. Ocean Conditions

Until recently, the biological resources of oceans were considered stable and limitless. Seasonal differences have always been recognized, but the more recent documentation of regime shifts such as El Nino and La Nina and their impacts on fisheries have forced a re-evaluation of the resources of the ocean.

According to BC researchers, fitness and size of adult fish is a function of ocean productivity and temperature. Warmer, less productive ocean conditions result in smaller, less fecund, less viable adult salmon.

These studies generally showed very low SARs (0.1 to 0.5%) from many hatcheries. Therefore, it is logical to expect low SARs if poor spawning and rearing habitat produces poor quality wild smolts. In the late 1980's and early 1990's, wild juveniles PIT-tagged the summer before they migrated survived at 2 to 20% rates to Lower Granite Reservoir. The 80 to 90% over-winter mortality was a measure of poor rearing habitat.

Note also that different stocks of salmon migrate to different locales in the ocean. NMFS does not tell us where Snake River spring chinook and John Day River spring chinook go while in the ocean. There is a strong indication that the fishery managers' theory that they all go to the same place in the ocean and utilize habitat similarly is incorrect.

Since the early 1980's the California Current (a broad, slow, meandering, current moving in the Pacific Ocean that extends from the northern tip of Vancouver Island to the southern tip of Baja California and extends from the shore to several hundred miles from land) has been experiencing an increased frequency of El Nino events which has seldom reached as far north as Oregon in the past. Since 1992 the Oregon and Washington coasts have been experiencing almost continuous El Nino conditions during the summer and there has been a decline in coho salmon survival.

There is improved understanding of the link between marine fisheries and climatic conditions; however, there is so much not understood. Presently, the management approach involves "hedging" by managing based on historical and average "cyclical" ocean conditions. A better understanding of the lengths and causes of these adverse ocean and climatic conditions would enable the region to make better fish management decisions.

Because there is so little baseline ocean data, it is difficult to establish how much mortality is in fact attributed to impacts encountered in freshwater habitats and how much is due to poor ocean conditions. We need to increase our efforts to gather baseline ocean data.

Dr. David Welch conducted research that indicates there are stocks of chinook and coho salmon remaining in southern areas of British Columbia coastal waters which have much lower rates of growth than do fish from the same species feeding in regions to the north. They also have lower fat stores.

The preliminary information indicates that these reduced rates of growth and energy storage are the result of lower rates of food consumption in the southern region. There is an indication that the fish in the northern region have a 3 times better chance of survival by the end of the first summer in the ocean, and an 8 times greater survival advantage at the end of their marine life history phase if the growth rate differences continue until the second year in the ocean. The farther north coho or chinook were sampled, the larger their mean body size, hence the lower the mortality.

Therefore, the regions that specific stocks of salmon forage in will have an important influence on their ocean survival. The indication is that reduced ocean productivity and elevated ocean temperatures will have the most impact on the growth and survival of the salmon foraging in the southern areas.

According to Dr. Welch,[74] the differences in marine growth between different regions of the West Coast of North America could have at least three causes:

- Differences in ocean productivity Growth and survival differ between regions because the amount of food available is lower in southern regions.
- Differences in temperature Growth and survival differ because regions to the south are warmer. Salmon are cold-blooded so they incur higher basal metabolic costs in southern regions and have less energy left for growth.
- Genetic differences Salmon populations that are genetically determined to have marine migration patterns that bring them to southern regions where they remain and forage also have lower growth rates and are therefore smaller because activity costs are higher.

The impacts of hydro, hatcheries, harvest and habitat on salmonids in the Pacific Northwest are better understood than the impacts of natural phenomena such as climatic changes and ocean conditions. If the focus is limited to only four of the H's, there will be a failure at making regional dialogue broadly focused. There is a sub-H that needs to be included to make this a broad discussion, the high seas.

In the draft All-H paper, the Federal Caucus (Caucus) noted that they hope to encourage a broadly focused constructive debate. However, there are no references in the final Plan addressing the impacts of changing climatic and ocean conditions on the declining populations of salmonids in the Pacific Northwest.

The Caucus considered a range of options for each "H' with three purposes:

1. Consider solutions or actions that had not yet been explored.

Dr. D. James Baker, Undersecretary for Oceans and Atmosphere, NOAA, testified before the House Sub-Committee on Fisheries, Conservation, Wildlife and Oceans on March 18, 1999. He requested $19.1 million to fund research on Climate in the 21st Century. He said, "We are finding that changing ocean circulation patterns, in addition to affecting climate,

74 *See* David W. Welch, PhD, *Testimony to the Committee on Energy & Natural Resources, United States Senate,* (visited September 15, 2000)<http://efw.bpa.gov/EW/SUBJECTS/OCEAN/990609. Welch. testimony .pdf>.

have a profound effect on fishing resources. For example, changing circulation patterns may affect the salmon and pollack off the shores of Alaska."[75]

This is just one of many examples of the NOAA's increasing awareness that there is something more going on in relation to declining salmonids in the Pacific Northwest than just the impacts of the "Four H's." Yet, no reference was indicated to any research efforts in the habitat section in strategies; options; research, monitoring and evaluation; or key uncertainties.

2. Test the sensitivity of different fish populations at various life stages to actions in the different H's.

How can this be done successfully without considering the life stage spent in the ocean or high seas? We need to know ocean mortality compared to freshwater mortality. Salmon spend most of their life in the ocean, and it does not make sense to only consider sources of freshwater mortality. There are no proposed actions in the Plan to address these uncertainties.

3. Stimulate regional dialogue on the trade-offs and uncertainties involved in selecting a suite of actions to recover salmon and steelhead populations.

The regional dialogue is incomplete without considering climate and ocean impacts on the declining salmonids. The Independent Science Group made it clear in their "Return to the River" publication that the region had to consider all four stages of the life cycle of the fish in order to fully understand the causes of decline in fish populations. They emphasized that in order for the region to formulate a "suite of actions to recover salmon and steelhead populations" we have to understand impacts in the headwaters, mainstem, estuary & ocean, as well as environmental and human impacts to these fish. Again, the All H paper falls short of stimulating dialogue on a very important critical uncertainty - the ocean or high seas.

The NWPPC has been directed by Congress to "consider the impact of ocean conditions on fish and wildlife populations" in making its recommendations to Bonneville regarding projects to be funded. There are several projects being funded through the Council's Fish and Wildlife Program relating to impacts of ocean conditions that agencies of the Federal Caucus are involved in. There is an increasing awareness of the impacts of climatic and ocean conditions on declining fish populations in the Pacific Northwest. The region as a whole has to incorporate impacts of ocean conditions on salmon and steelhead recovery into discussions and policy decisions.

The NWPPC recently sponsored an Ocean Conditions Symposium in their effort to facilitate discussion of this issue in the region. Their goal is to make progress toward a

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75. Dr. James Baker, *Testimony of Dr. James Baker Under Secretary for Oceans and Atmosphere National Oceanic and Atmospheric Administration Before the Subcommittee on Fisheries Conservation, Wildlife and Oceans Committee on Resources U.S. House of Representatives* (March 18, 1999) (last visited May 13, 1999)<http://www.house.gov/resources/106cong/fisheries/99mar18baker.htm>.

broader view of salmon management and to discuss regional perceptions about the interaction between salmon and the ocean environment. Participating and attending were leading authorities in the fields of climatology, oceanography, fishery sciences, representatives of federal agencies, Council members, tribal representation, members of the public, and private interests.

9. Habitat Strategies and Objectives

In 1982, Congress amended the Endangered Species Act to allow an applicant to develop habitat conservation plans, or HCPs, that will permit a "take" of a listed species incidental to an otherwise lawful activity if sufficient mitigation is included in the agreement.[76]

An HCP may be developed by a private landowner, state agency, local government, or others who are "faced with having otherwise lawful actions not requiring federal permit prevented by [ESA] section 9 prohibitions against takings."[77]

To issue an incidental take permit, the consulting agency must find that:

- The taking will be incidental;
- The applicant will minimize and mitigate the impact of such takings;
- The applicant will ensure that adequate funding for the conservation plan and procedures to deal with unforeseen circumstances will be provided;
- The incidental taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild;
- The consulting agency has received other assurances as may be required that the plan will be implemented.[78]

Idaho supports voluntary habitat conservation plans for landowners seeking to utilize this tool under Section 10 of the ESA. The state has been actively pursuing federal funds to provide the scientific infrastructure, so that potential participants to an HCP process can make an informed decision based on fundamental baseline scientific data.

The planning and preparation by a private entity seeking this type of "safe harbor" relief under the ESA are cost-prohibitive. For example, the Plum Creek Timber Company invested millions of dollars in developing its own data prior to negotiating its HCP with United States Fish and Wildlife Service.

Costs of this magnitude are not affordable by many private landowners whose operations may be of a lesser magnitude. Accordingly, it is up to the federal government to provide appropriate funding if the concept of HCPs is to have any utility and flexibility as a tool for habitat improvement.

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76. H.R. REP. NO. 97-835, at 29 (1982), *reprinted in* 1982 U.S.C.C.A.N. 2860, 2870.
77. *Id.*
78. 16 U.S.C. § 1539(a)(2)(B)

10. The Need for Additional Research

The Plan makes the assumption that habitat is a universal problem within the 23 subbasins in the Columbia River Basin. Idaho has conducted extensive monitoring and have compared the results to the EPA-approved water quality standards and the results do not support the broad-based assertion that habitat is a universal problem.

The data support the fact that problems do exist in some areas, and Idaho is or will address these problems through the TMDL process. If the document has used different criteria then water quality standards on which to base assertion, the criteria should be clearly defined as to what was used and why. If any of the criteria are different from those found in Idaho's federally approved water quality standards, it should be explained where Idaho's standards are deficient.

It would be assumed that since some stocks have been listed for many years that critical watersheds would have been identified and the degree that the loss of habitat on these stocks would be known. The Plan discusses preserving habitat in critical areas and in key watersheds but fails to identify where these exist. If states are to aid in the recovery of salmon and steelhead, the priority watersheds must be known and exactly what conditions exist in the key areas. The Plan does not identify the highest priority watersheds or exactly what conditions are affecting recovery.

It is suggested that rather than requesting the states to commit to a recovery plan, states should be asked to enter into a process to identify where the problems exist and the degree these problems influence the recovery process. The problem should be identified and well defined prior to moving into a given course of action. This would eliminate the waste and false starts which have characterized the past salmon recovery efforts.

It is unclear what data were used to determine that habitat problems are wide spread in the basin. If the basis for the evaluation was the data used from the Upper Columbia River Basin project, this data has been questioned as to its accuracy and quality. The use of this broad scale information should not be used in light of the potential economic and political consequences of the decisions to be made. Much of the monitoring information from Idaho as it relates to water quality does not paint the same picture as does that presented in the documents. It is suggested that site specific monitoring should be used where available.

It is not clear how the tributaries effect salmon. The EPA model for temperature would indicate that tributaries have little if any effect on water temperature. Could this be the same situation with many of the habitat parameters?

The Plan implies that habitat on non-federal lands is a problem. The Clearwater and Salmon watershed contain approximately 35,700 stream miles. Of this 29.8% are state or private lands with the remainder being in federal ownership. Little, if any information is available to demonstrate that the state and private lands have major habitat problems. Further, it is not clear whether private and state lands are located in critical habitat areas.

Through the TMDL activities, Idaho is addressing the problems and is developing implementation plans to carry out the needed corrective actions. As has been noted, the

TMDLs are based on watersheds and address all of the water quality problems identified for the area.

Idaho has strengthened the Forest Practices Regulations to prevent degradation of existing habitat. These regulations apply to private, state, and federal lands in Idaho. A process is in place for periodic review of the effectiveness of the regulations and how they are being implemented on the ground. During the review the practices are reviewed and needed improvements recommended.

The Total Dissolved Gas (TDG) in the Clearwater River is for the most part caused by the flow augmentation for salmon. Idaho is caught between two federal laws, the Clean Water Act and the Endangered Species Act. When flows from Dworshak are elevated in order to provide cooler water for salmon, the TDG exceeds Idaho standards. This results in the Clearwater River being placed on the 303(d) list under the Clean Water Act. Without the requirement for spill, the Clearwater River would meet water quality standards.

While NMFS had recognized the importance of salmon carcasses in restoring stream fertility, there is no mention of stream fertilization projects in the Plan. Research in Canada and in western Washington have investigated the use of fertilizer approximating decomposing salmon carcasses. Considering the current shortage of salmon carcasses, it would be beneficial to conduct experiments with fertilizer in Idaho or eastern Oregon and Washington. Control streams should be established for comparison and juvenile fish tagged and monitored. Disposal of carcasses was discussed at a Dworshak Hatchery meeting in November1999. The COE and Idaho Department of Fish and Game were evidently in agreement that carcass disposal was a good idea, yet USFWS decided not to follow through.

Current information is also needed on egg-to-smolt survival for comparison with egg-to-smolt survival with improved habitat and stream fertility. This is an item that should be initiated immediately so that background information will be available by which to judge the performance of habitat improvement measures in the future.

11. Performance Standards

Idaho does not agree that SARs are the best performance standard to measure the effectiveness of actions taken to improve juvenile fish survival. There are too many other variables that could affect fish survival. If the juveniles are in poor condition when passage occurs in the hydropower system, the less likely survival becomes. Healthy, robust fish should survive the hydropower system or transport passage better. The condition factor is not being considered in evaluation of the survival of fish between years. Poor estuary and near ocean conditions may affect one group, and the conditions could be better for another group. Ocean survival to adulthood could depend on where a given group of fish migrated to in the ocean and what predators were found in their path both as juveniles and adults.

In addition, Idaho finds fault with the programmatic standards. The danger in measuring performance at five and eight year intervals is that climatic changes or ocean conditions could affect survival to the extent that these factors mask the effect of survival increases due to recovery measures. Therefore, it is necessary to have a measure of the effect of climatic or ocean condition changes during the study period.

The Plan advocates a performance standard schedule of review at year five and year eight. There is no rational basis for this five and eight year schedule. The choice of a five and eight year checkpoint is arbitrary, and nowhere does the Plan explain the rationale for these checkpoints. Given the aforementioned implementation obstacles, it may take five years to get coordination accomplished. Idaho asks for an explanation for these time frames. It is noteworthy that the Caucus expects an eight-year solution for a one-hundred year problem.

PROPOSED HABITAT MEASURES

Habitat in General

- Predator control should maintain a strong presence in regional debate over salmon recovery.
- Federal funds should be made available to Idaho to provide the scientific infrastructure for voluntary habitat conservation planning by those who might decide to utilize this tool under Section 10 of the ESA.
- Study stream fertilization, including but not limited to, carcass disposal.
- All habitat implementation actions should be authorized and implemented through the Office of the Governor, Office of Species Conservation.

Screening

- Continue to seek federal funding sources for diversion screening.
- Diversion consolidation projects should be funded to improve water conservation and reduce multiple screening and biological impacts.

Predator Control

- Develops and implement a plan to reduce Caspian terns, as well as double-breasted cormorants and gulls, to mid-1980s levels by 2002. As listed fish stocks are recovered, reassess appropriate balance of fish and birds.
- Ensure no nesting occurs near the salt/freshwater interface by lowering all artificially created dredge-spoil islands to below high-tide levels.
- Assist natural revegetation of all islands not located in the salt/freshwater interface.
- Actively harass birds foraging on smolts near the salt/freshwater transition zone.
- Identify and create alternative nesting sites outside of the lower Columbia River and estuary. Encourage birds to utilize these nesting sites.
- Restore natural connectivity of estuary wetlands and tidal zones by removing dikes created by dredge spoils.
- Do not allow shipping channel dredging to further diminish natural estuary habitats.
- The NMFS should non-lethally remove individual opportunistic pinnipeds from areas where adult salmonids are concentrated and particularly vulnerable.
- Congress should amend the Marine Mammal Protection Act to include lethal take by state and federal resource management agencies and commercial fishers.

- Congress should support housing facilities for pinnipeds at inland zoos in order to facilitate placement of these animals.

Water Quality

- Establish uniform temperature gathering methods and protocols to assure consistency between federal, state and tribal data.
- Continue to utilize the TMDL and 303(d) process already in place for water quality.
- Continue to implement agricultural conservation land management practices with a priority on anadromous waters and tributaries.
- Integrated rule curves should be developed for Dworshak and other appropriate reservoirs.

Land Management Practices

- Continue implementing the Idaho Forest Practices Act and site specific practices to protect water quality within forested areas.
- Provide federal funds to develop the necessary scientific infrastructure for informed decision making by those assessing voluntary habitat conservation planning under Section 10 of the ESA.

Estuary/Ocean Conditions

- Identify any differential mortality by evolutionary significant unit (ESU) related to different growth rates and ocean distribution.
- Research to establish baseline for growth and survival in ocean in good and bad years.
- Evaluate actions in freshwater for the effects of marine survival.

B. HARVEST (VOL. 2, P. 37)

IDAHO'S PERSPECTIVE:

> **HARVEST IMPACTS ON LISTED ADULT SALMON AND STEELHEAD MUST BE RESPONSIVE TO CONSERVATION NEEDS OF THE FISH. JUST AS WITH THE OTHER HS, THE IMPERILED STATUS OF LISTED STOCKS REQUIRES MODIFICATION IN THE HARVEST ARENA.**

FOUR GOVERNORS RECOMMENDATION:

> **WE RESPECT THE LEGAL STATUS AND CULTURAL IMPORTANCE OF INDIAN TREATY FISHING RIGHTS. CHANGES IN HARVEST MANAGEMENT SUGGESTED BELOW MUST BE DEVELOPED IN PARTNERSHIP WITH THE TREATY TRIBES SO THEY ARE CONSISTENT WITH THE ONGOING HARVEST AND PRODUCTION LITIGATION UNDER *U.S. V. OREGON*, AND ALSO WITH FEDERAL AND STATE GOVERNMENTS TO COMPLY WITH THE PACIFIC SALMON TREATY.**

Healthy, sustainable fisheries are clearly a long-term goal of Idaho. During the interim, harvest impacts on listed adult salmon and steelhead must be responsive to conservation needs of the fish. The imperiled status of listed stocks requires sacrifices by all stakeholders in the harvest arena, as it does throughout the other sectors. The federal government should not allocate the full burden of conservation to non-Indian activities before regulation of tribal fishing. As the Plan asserts (Vol. 2, p. 37), most of the harvest of Columbia Basin fish today occurs in treaty-protected tribal fisheries.

The federal government satisfies its trust responsibilities by ensuring tribal concerns are considered in implementation of the ESA.[79] It may become apparent that in order to *satisfy* it's trust obligations, the federal government must recommend that all harvest be severely limited or curtailed. Many sacrifices have already been made, but several fisheries still provide substantial opportunity for conservation benefits from reduced harvest of listed fish.

Continuing current harvest ceilings is not correct harvest management. No harvest should be allowed on listed stocks until they have been restored. NMFS is continuing to

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79. Appendix Sec.2. (C) to Secretarial Order #31106, entitled *"American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act,* issued June 5, 1997, in Washington, D.C., by the Secretary of the Interior and the Secretary of Commerce.

allow harvest and incidental take of listed stocks at existing, and sometimes expanded levels. Columbia River fall chinook will be harvested at a rate of over 30% this year. Snake River fall chinook will be migrating upstream at the same time as the more abundant Hanford Reach fish, exposing the Snake River fall chinook to a higher rate of harvest. The Plan acknowledges that harvest reductions produce immediate increases in spawning escapement, thereby reducing the near-term risks of extinction more quickly and certainly than *any other* conservation method, yet this is not recommended (Vol. 2, p. 37).

Harvest managers should reevaluate their methods of determining escapement requirements. Simply knowing how many adults it takes to produce a certain number of eggs to produce a given number of juveniles is not adequate. It may take more adults than measured in terms of numbers of eggs laid to provide enough fish carcasses to maintain the fertility of a stream. With the gross overharvest and shipment of millions of salmon eggs out of the region that continued through the 1960's, it is possible that the Columbia River salmon runs would have been on the brink without construction of the FCRPS. Many stocks met their demise long before the FCRPS dams were built.

One aspect of gillnet harvest that NMFS has not considered is the fact that gillnet mesh size has steadily increased over the years, with the purpose of reducing take of smaller fish. Unfortunately, the biggest and best breeding stock are caught and removed from the run. This has resulted in a decrease in the average size of salmon over the years. It has also reduced the average fecundity, and from British Columbia's experience, has removed the strongest and most fit to survive individuals from the population. Instead of targeting the bigger, more robust, most fit fish, NMFS and harvest management agencies should be eliminating the use of gillnets. Fish that are too small to be caught in gillnets are often injured by them, decreasing their chance of survival and exposing them to a higher risk of disease. Instead of accounting for gillnet mortality, NMFS attributes such losses to the FCRPS. Approximately five years ago, California banned the use of gillnets in fresh water and near coastal waters.

The importance of marking all hatchery fish should be emphasized for selective harvest. Fishery agencies have opposed marking in the past because they had other uses for marked fish. The adipose fin clip should be applied to every hatchery fish. The CWT technology has been overtaken by PIT tag technology. CWT's require removal from the fish before they can be read. This means that the fish must be dead and the tag dissected out and read under a microscope. Information can only be gathered after the fish are killed or die. Conversely, PIT tags can be read wherever the tagged fish goes through a detector. For smolt tagged at a hatchery or rearing ground, it can be read downstream for returning adults, at the dam where it is collected, when it is loaded into a truck or barge, if it is not transported, at dams downstream, at each dam as it migrates upstream, and at the hatchery weir across a spawning stream. Not surprisingly, the cost of PIT tags is higher ($2.40 a piece compared to a few cents) but the added information and ability to gather information without handling or sacrificing fish is worth the extra cost.

Idaho has difficulty accepting the notion that NMFS could allow over 30% harvest on Snake River fall chinook and 17% on Snake River "B" run steelhead. The NMFS is allowing fisheries that cause more mortality than the dams.

Deference to minimum escapement, stock productivity, and genetic diversity within and among populations are mandatory conservation requirements.

1. Overview of *U.S. v. Oregon*

Issues related to the production and harvest of Pacific Northwest salmon have, for several decades, largely been managed by the landmark United States v. Oregon litigation.[80] The litigation began in 1968, when two actions were brought against the State of Oregon by several tribes seeking to resolve their treaty rights to fish at all usual and accustomed places on the Columbia River.[81]

Because of the consolidation of several other parties, the litigation has moved through numerous appellate stages.[82] In 1983, the State of Idaho was allowed to intervene in the action as a matter of right. Pursuant to an agreement with the parties to the litigation, Idaho has acquiesced to current harvest levels for a limited time.[83]

The *U.S. v. Oregon* process is a useful forum to resolve harvest issues. In the past, parties to the agreement have chosen to include production within the scope of their negotiations. However, the parties must recognize that artificial production and funding decisions are within the authority of other entities and agencies. However, the State remains concerned that the process has Balkanized regional salmon recovery decision making because of its disconnection with other recovery components. It is imperative that the harvest decisions from *U.S. v. Oregon* be consistent with the other recovery measures proposed in the other H's.

2. In-State Fisheries

a) Nontribal Fisheries

The Idaho Fish and Game Commission has adopted conservative harvest regulations for in-state nontribal fisheries. It has been illegal to harvest wild adult salmon in Idaho since the late 1970s and wild steelhead since the mid-1980s. Idaho has not had a statewide general chinook fishery for over 20 years. Limited fisheries targeting non-listed fish near some

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80. 699 F. Supp. 1456 (D. Or. 1988), *aff'd*, 913 F.2d 576 (9th Cir. 1990), *cert. denied*, 501 U.S. 1250 (1991).
81. *See* Sohappy v. Smith, 302 F. Supp. 899 (D. Or. 1969), and *United States v. Oregon,* 699 F. Supp. 1456, 1458-1460 (D. Or. 1988) (describing background of the cases). *Sohappy* challenged the extent that the state of Oregon could regulate tribal fishing in light of Puyallup Tribe v. Department of Game, 391 U.S. 392 (1968). Puyallup Tribe held that the state of Washington could, in the interest of conservation, regulate the type of nets used by the tribe to exercise their treaty fishing rights. *But c.f.* Department of Game v. Puyallup Tribe, 414 U.S.. 44 (1973) (striking down subsequent ban on all net fishing for steelhead in the Puyallup River as discriminatory against Native American treaty rights). *Sohappy* and *United States v. Oregon* were consolidated and designated *United States v. Oregon.*
82. *See* United States v. Oregon, 529 F.2d 570 (9th Cir. 1976); United States v. Oregon, 718 F.2d 299 (9th Cir. 1983); United States v. Oregon, 745 F.2d 550 (9th Cir. 1984).
83. See 1999 Management Agreement for Upper Columbia Fall Chinook, Steelhead and Coho, Order, United States v. Oregon (Civ. No. 68-513-MA, D. Or.).

hatcheries have occurred occasionally; regulations require immediate release of any wild fish caught.

The overall incidental mortality associated with these limited fisheries (i.e., delayed mortality from catching, handling and releasing wild fish) is less than 1% for chinook and less than 3% for steelhead, based on the total run of listed fish over Lower Granite Dam.

b) Tribal Fisheries

In-state tribal fisheries taking listed fish are very limited; approximately 1% or less of the total run of listed spring/summer chinook over Lower Granite Dam, and even less for steelhead. Tribal fisheries are typically directed at hatchery stocks, but in some areas listed fish are mixed in the run. Usual and accustomed fishing techniques of the Nez Perce Tribe allow live release, which the Tribe has often utilized when listed fish are present. Usual and accustomed fishing techniques of the Shoshone-Bannock Tribes do not include the opportunity for live release.

Additional constraints on ocean and in-river non-tribal and tribal fisheries provide some opportunity to gain conservation benefits for listed Snake River spring/summer chinook, although opportunities for additional protections should not be overlooked. Current harvest rates of Snake River spring/summer chinook range from 6-9% in lower river fisheries and less than 2% in ocean fisheries.

Although reductions have occurred (e.g., 30% reduction since the 1988-93 base period), current harvest rates remain high for listed Snake River fall chinook in downriver and ocean non-tribal and tribal fisheries. This is a significant conservation concern. Harvest rates in ocean and lower river fisheries are approximately 40-60% each.

These high rates, relative to spring/summer chinook, occur because listed fall chinook are intermingled with more abundant unlisted fall chinook stocks targeted by fisheries. These mixed-stock fisheries have been slow to embrace opportunities for selective fishing techniques, which would target the abundant stocks while allowing higher escapement of listed fish.

Additional modifications of ocean and in-river nontribal and tribal fisheries provide little opportunity to gain conservation benefits for listed Snake River steelhead, except for fisheries harvesting wild B-run steelhead. B-run steelhead are typically larger and return later than A-run steelhead, causing them to intermingle with the relatively abundant upriver bright fall chinook stock, which is the primary target of the lower Columbia River fall season fishery.

The tribal mixed stock fishery has been slow to embrace selective fishing techniques. Following the listing of Snake River steelhead in 1998, NMFS established a 17% ceiling on harvest of listed B-run steelhead in mainstem Columbia River fisheries (15% tribal; 2% non-tribal). This rate is significantly higher than the harvest rate of listed spring/summer chinook, and represents an opportunity for additional conservation benefits. Current harvest rate of listed A-run steelhead in lower river fisheries is approximately 7-8%. Snake River steelhead are rarely taken in ocean fisheries.

c) Fish Bank

The ability of states, tribes, federal agencies, and others to engage in free discussion of ideas and opinions is vital to the long-term success of the Northwest's salmon recovery efforts. With that goal in mind, this Plan outlines a concept of a Columbia River "fish bank." Under this concept, the Columbia River Tribes' commercial fall season harvest entitlement would continue to be determined pursuant to *U.S. v. Oregon* legal principles. The Columbia River Tribes would have the option to elect not to take a portion of this entitlement in exchange for a conservation rental free. This election would be made solely at the tribes' discretion on a season-by-season basis and would not alter any tribe's treaty fishing rights. Fish that are not harvested would in effect be put into the bank for spawning, thereby increasing returns in future years.

This concept is intended to help parties explore the Fish Banks. It is not a proposal and has not been endorsed by any party. The Fish Bank concept can only go forward if the Columbia River tribes believe that the idea deserves serious consideration. It is not a proposal and has not been endorsed by any party. The fish bank concept can only go forward if the Columbia River Tribes believe that it deserves serious consideration.

Since the listing of Snake River salmon stock in the early 1990's, Idaho irrigators have voluntarily rented water to the U.S. Bureau of Reclamation for the purpose of augmenting river flows during the salmon migrating. The water rental process is governed by rules adopted by Idaho Department of Water Resources, which establish water banks in various parts of the state. Each year, irrigators decide whether they want to put a portion of their reservoir storage rights into a water bank in exchange for a rental payment. Over the last several years, this arrangement has supplied water for fish while at the same time providing an additional source of income to irrigators and protecting their legal right to use the water to irrigate their land if they choose to do so in the future.

A fish bank would be based on the same concept as the existing water banks. During the annual pre-season process, the *United States v. Oregon* parties would determine the approximate number of fall chinook and steelhead to be commercially harvested by the Columbia River Tribes under the applicable conservation and allocation guidelines. This preliminary estimate would serve as the basis for the tribe's decision whether to forego a portion of their commercial harvest entitlement. The tribes would then shape their fisheries to pass the pre-determined number of fish through the Zone 6 fishing area. At the end of the season, the difference between the number of fish actually harvested and the Tribes' entitlement would be calculated. The Tribes would receive a conservation rental fee for this foregone harvest from hydropower mitigation funds paid by the Bonneville Power Administration.

The fish bank concept attempts to address the concern that any further fishery restrictions will erode the treaty right. Rather than restrict the treaty right, the fish bank would actually affirm the tribes' treaty right to a particular share of the harvest. The tribes – not the National Marine Fisheries Service or the Columbia River Compact – would determine whether to forego harvesting a portion of this treaty share. The fish bank would recognize this voluntary sacrifice by paying the tribes a conservation rental fee.

Participation in the fish bank would not affect the scope or definition of the Tribes' treaty right. The tribes alone would decide the whether and to what extent then take part of the program. Participation in one year would not establish any precedent or expectation for future years.

3. Ocean Issues

a) Ocean Harvest

Harvest rates for commercial fisheries on wild fish remain excessive. The Plan states that last year's harvest rate on Snake River fall chinook was about 31 percent. However, this accounts only for fisheries within the Columbia River. When ocean fisheries are added, the cumulative harvest rate rises to roughly 50 percent. At a time when the Federal Caucus is considering economically devastating measures that will produce only meager biological benefits for Snake River fall chinook – such as increased Snake River flow augmentation – it defies logic that NMFS is still permitting the intentional harvest of roughly half of the members of that stock.

NMFS has permitted this level of harvest through a series of "no jeopardy" biological opinions. Which call for reducing harvest rates by 30 percent relative to the 1988 through 1993 base period. This standard is essentially arbitrary, and wholly ignores whether this reduction is sufficient to secure the survival of Snake River fall chinook, when combined with actions in other sectors. In fact, the 30 percent reduction appears to be based on what is needed in order to maintain the treaty/non-treaty allocation of the overall fall chinook run rather than on the survival needs of listed stocks.

Idaho does not call for the wholesale elimination of salmon and steelhead fisheries. We are sensitive to how such Draconian cutbacks would affect fishing-dependent economies from the headwaters of the Snake River to Alaska and, especially, Indian tribes that retain treaty-fishing rights. The NMFS must do more to encourage and even push harvesters toward selective fishing methods and to employ economic incentives to reduce impacts on wild stocks.

The United States and Canada have signed a 10-year Pacific Salmon Treaty that implements an abundance based harvest regime for chinook and coho, which places restrictions on fisheries that harvest weak stocks and mandates a required number of fish on spawning grounds. Idaho questions whether an abundance-based regime is adequate. As the numbers of fish go up, so does the number of fish taken, leaving us with no improvements at the end of the day. A random observer program is needed to collect information to be used in reducing bicatch mortality. Law enforcement should be strengthened to ensure accountability and reduce illegal catch.

b) Bi-Catch, Discard and Hooking Mortality

"Bi-catch" are fish which are caught in a fishery but which are not sold or kept for personal use and includes economic and regulatory discards. "Discards" do not include fish released alive under a catch-and-release fishery.

In light of the premium placed on every listed protected fish in the Northwest, it is time for state and federal fishery management agencies to deal with the issue of bi-catch discards. The Pacific Fishery Management Council (PFMC) is developing ground-fish bi-catch reduction strategies. However, little is being done to ensure that the salmon bi-catch industry discards are being appropriately accounted for. Accurate knowledge of discards is key to determining the total amount of fish removed from the ocean which are vital to setting safe harvest limits as required by Congress and litigation.

To illustrate the problem, during 1977, observers monitoring a small portion of trawl fisherman off Oregon and Washington found that nearly 44 percent of the fish harvest was dumped over-board. Fisherman discard fish that lack markets or exceed landing limits. Observers hired by the Oregon Department of Fish and Wildlife surveyed the fate of more than 2.3 million pounds of fish brought onto the trawler decks. They reported more than 1 million pounds and more than 14 species of fish were tossed back overboard.

The PFMC has recommended a program to recover the value of discards from bi-catch. One option is to provide for the landing of overages in order to capture the value of fish being discarded. Permitting of landing of overages would allow commercial fisherman to keep their catch, remove consequences and provide funds for fishery research, observer programs or provide food for the less fortunate.

The bi-catch and discard effects on Snake River salmon are thought to be relatively small. Some estimates range as low as 1 percent but perhaps as high as 5 percent. The number of the Snake River salmon from the Oregon boundary to southeast Alaska is a very small percentage of the total salmon in this area. However, without an observer program and a prohibition on landing those listed species, there are no reliable data available on this issue.

The Canadian net fisheries target pink and sockeye salmon, and Snake River chinook are not usually found among those species. Many Alaskan and Canadian fisherman complain of restrictions of the salmon catch because some Snake River fish may be present. However, there is support in Canada for reduction of chinook salmon catch to allow more return of Snake River salmon and other United States species. For the PFMC area (generally Washington and Oregon) the total harvest impact on Snake River Fall chinook due to all ocean salmon fisheries is 26 percent, with 12 percent of southeast Alaska and 62 percent for Canada. This data is developed by the PFMC and is based on the 1988 to 1993 average.

The options selected by the PFMC in April 2000 reach the objectives for threatened Snake River Fall chinook impacts of no more than 70 percent of the 1988 to 1993 average impact level for all ocean fisheries combined. Expected reductions in Canadian fisheries from the levels of previous years contribute greatly to this result.

"Incidental fatality" means the death of salmon due to encounters of any form of fishing gear which does not result in a legally landed catch. When fishers target adult chinook salmon there is also an incidental hooking mortality on sub-legal chinook.

Professor Steven Matthews from the University of Washington has estimated that about 30 percent of all available chinook are killed and not kept as a result of hooking mortality. In the past, Washington and Oregon have used a hooking mortality rate of 13 percent. California has used a hooking mortality as high as 31 percent.

A 1998 study looked at encounter rates, as well as the rates of mortality for chinook and coho salmon captured on sport and commercial gear and released. The study suggests that the current applied methodology for estimating salmon encounter rates in Oregon are underestimated. The study stated that the hooking mortality was 1.66 times the rate of the Oregon estimate.

In summary, there are many unknowns in the bi-catch, discard and hooking mortality and drop-off rates for salmon in the Pacific Northwest. Observers are needed on fishing vessels, and more research is needed on hooking mortality and drop-off rates. The available data indicate that the total non-landed mortality of salmon in the Pacific Ocean is in the range of 20 to 30 percent.

PROPOSED HARVEST MEASURES

Harvest In General

- Harvest practices must make a transition from fisheries where more than one stock is present to fisheries where a single stock is present. Fishery managers need to expand the use of existing selective fishery techniques.
- The region must launch an aggressive program to understand more about migration timing and movement of individual stocks to develop better selective fishing techniques.
- There must be a strong regional commitment to providing financial incentives to move toward selective fisheries or other means to reduce impacts and to provide economic mitigation to affected communities.
- The region must acknowledge the legal status and cultural importance of Indian treaty fishing rights. Changes in harvest management must be developed in partnership with the states, federal government, and the tribes.
- Future increases in harvest rates should be tied to sustained improvements in wild stock productivity, not to yearly swings in escapement. Basing harvest rates on sustained improvements in underlying productivity will ensure that harvest does not unduly constrain population rebuilding.
- Study the possibility and effectiveness of salmon refuges

Ocean Harvest

- The federal government should strive for a biologically based ocean harvest regime to encourage selective fishing techniques and economic incentives to reduce impacts to listed stocks.

Bi-Catch

- Provide random observers on fishing vessels so that issues related to bi-catch mortality can be assessed.

Snake River Basin Non-Tribal Fisheries

- Determine appropriate harvest levels based on fishery impacts to listed fish.
- Continue fish marking program to ensure accurate differentiation of listed and non-listed fish and only promulgate selective fisheries targeting non-listed hatchery fish.
- Require immediate release of all listed adult salmon and steelhead caught in sport fisheries. Continue to use season and area fishing closures to further protect adult salmon and steelhead.
- Ensure that fish stocking from mitigation hatcheries minimizes predation and competition with listed fish, and does not focus fishing pressure on key natural production areas.
- Protect listed juvenile salmon and steelhead in resident trout fisheries by marking hatchery resident trout and enforcing catch-and-release or other restrictive regulations in key natural production or migration areas for listed fish.
- Provide adequate monitoring and evaluation of fisheries to detect unanticipated impacts and adapt programs accordingly.

Snake River Basin Tribal Fisheries

- Determine appropriate harvest levels based on fishery impacts to listed fish.
- Maintain ceremonial and subsistence fisheries targeted on hatchery salmon and steelhead adults.
- Minimize impacts to listed stock by:
  1) not allowing fisheries in areas with only naturally produced listed fish;
  2) focusing fisheries in areas without listed fish, or with primarily hatchery-supported listed or non-listed stocks;
  3) ensuring fishery location, timing and magnitude are based on conservation criteria for listed stocks; and
  4) encouraging selective fishing techniques allowing live release of listed fish.

Lower River Non-Tribal Fisheries

- Determine appropriate harvest levels based on fishery impacts to listed fish.
- Require live release of all listed spring/summer chinook and steelhead caught in the mainstem of the Columbia River.
- Develop genetic or other methods to differentiate listed and non-listed fall chinook to allow live release of listed fish and better shaping of fisheries to protect listed fish.
- Investigate the opportunity to mark all non-listed hatchery fall chinook and focus the fishery on these stocks with reduced daily and seasonal bag limits on all unmarked fall chinook.
- Focus fisheries on non-listed fish at locations and during seasons that help reduce catch of listed fish.
- Use estimated delayed mortality for caught and released listed fish to determine magnitude of fishery.

- Provide federal financial compensation for all foregone fishery benefits resulting from conservation requirements. Provide financial incentives for developing and implementing selective fishing or other conservation techniques.

Lower River Tribal Fisheries

- Determine appropriate harvest levels based on fishery impacts to listed Snake River spring/summer chinook, A-run steelhead and sockeye.
- Reduce current level of impact on listed fall chinook and B-run steelhead while maintaining or increasing harvest of non-listed fish.
- Develop selective fishing techniques and ensure listed and non-listed fish are distinguishable within those fisheries.
- Maintain marking programs to differentiate listed steelhead and spring/summer chinook from non-listed fish. Develop methods to differentiate listed and non-listed fall chinook to allow live release of listed fish and better shaping of fisheries to protect listed fish.
- Employ and evaluate nine-inch mesh gillnets and more selective placement of gillnets.
- Require live release of all listed fish caught in platform fisheries
- Develop additional platform fisheries at the dams associated with fish ladders.
- Develop other selective fishing techniques to better conserve listed stocks while maintaining or enhancing harvest of non-listed stocks.
- Investigate opportunities to mark all non-listed hatchery fall chinook and focus mainstem fishery on these stocks with reduced daily and seasonal limits on all unmarked fall chinook.
- Ensure conservation benefits resulting from proposed measures accrue proportionately to the spawning grounds.
- Provide federal financial compensation for all foregone fishery benefits resulting from conservation requirements.
- Provide financial incentives for developing and implementing selective fishing or other conservation techniques.
- Exploration of a "fish bank" that would facilitate conservation of endangered fish stocks while acknowledging and protecting tribal treaty fishing rights.

C. HATCHERIES (VOL. 2, P. 51)

IDAHO'S PERSPECTIVE:

HATCHERY PROGRAMS, AS A MEANS OF SUPPLEMENTATION FOR LISTED FISH STOCKS, ARE UNFAIRLY MINIMIZED AS A COMPONENT OF SALMON RECOVERY.

FOUR GOVERNORS RECOMMENDATION:

IT IS TIME TO RECOGNIZE THAT HATCHERIES ARE USED FOR MULTIPLE PURPOSES, PRIMARILY PRODUCING FISH FOR HARVEST BUT ALSO FOR REBUILDING NATURALLY SPAWNING POPULATIONS THROUGH THE TECHNIQUE OF SUPPLEMENTATION AND FOR CAPTIVE BROODSTOCK EXPERIMENTS. CAREFUL THOUGHT MUST BE GIVEN TO HOW THESE TECHNIQUES COULD MAXIMIZE THE EFFICIENCY OF FISH PRODUCTION TO PROVIDE TREATY, SPORT AND COMMERCIAL HARVEST OPPORTUNITIES WHILE ALSO PROTECTING AND REBUILDING UNIQUE FISH POPULATIONS AND COMPLYING WITH EXISTING LAWS AND LEGAL PROCESSES, SUCH AS THE *U.S. V. OREGON* LITIGATION.

1. Current Conditions

Major salmon and steelhead hatcheries in the Snake River Basin were developed as part of congressionally and/or judicially-approved plans to mitigate for fishing opportunities lost due to economic development in the region. The valuable and highly prized steelhead (and occasional salmon) fisheries in Idaho are currently dependent on hatcheries.

The promise of fishery mitigation for the people of the Snake River Basin has never been fulfilled. Even with hatchery smolt releases of approximately 15 million annually in Idaho, adult mitigation targets for salmon have never been met and targets for steelhead fisheries are not met consistently.

Hydropower development, adverse ocean conditions, declining habitat throughout the Columbia Basin, and, perhaps, increased hatchery production, all have forced reliance on hatchery-supported steelhead and chinook runs. These contributing factors since the 1970s led to the decline of Idaho's salmon and steelhead, and fisheries managers became concerned about potentially adverse impacts on remaining wild runs. Additional stress on the wild runs include competition, predation, disease amplification and transfer, estuary conditions, genetic weakening, mining wild stocks for hatchery broodstocks, and elevated mixed-stock fishery impacts.

As wild runs of salmon and steelhead continued to decline, fish managers throughout the region began considering the potential benefits and risks of using hatchery-oriented programs to conserve and recover the species.

The State of Idaho has taken several steps to avoid adverse ecological interactions between hatchery fish and declining wild stocks. Examples are:

- Idaho was the first state in the region to mark all hatchery steelhead and chinook, allowing differentiation from wild fish for selective fisheries and broodstock management.

- Idaho is also the only state in the region to dedicate vast areas of steelhead and chinook habitat to wild production only.

- More recent actions include: minimizing steelhead smolt residualization through acclimation and refining the size of smolts released; reducing the total number of hatchery steelhead smolts released; further refinement of release sites to reduce potential interaction with wild salmon and steelhead; and strict hatchery protocols to ensure the health of the species.

In Idaho, these conservation hatchery programs have become quite extensive (particularly for chinook) and include traditional supplementation with juveniles and adults, captive rearing and captive breeding approaches. Because benefits, risks and approaches for this tool were not well developed, conservation hatchery programs were implemented with rigorous monitoring and evaluation. Refuge areas have been maintained for wild fish, at least until hatcheries become better refined and the benefits and risks are better known.

Conservation hatchery strategies can theoretically increase the number of naturally produced fish, but they cannot increase the survival of these naturally produced fish. However, as the region struggles to rebuild salmon and steelhead stocks listed under the ESA, it should not abandon the hatchery system's traditional role of supporting fisheries. Hatchery managers are increasingly facing the difficult task of allocating limited hatchery rearing capacity and brood sources among these competing needs, but it is not clear all these needs can be met.

In this light, supplementation programs must proceed cautiously and recognize that hatcheries cannot be relied upon as a sole source either to recover wild stocks or preserve the native genetic "engine" that made these stocks so historically productive. Conservation hatchery approaches are meaningful if they are coupled with rigorous improvement in the major factors limiting survival throughout the life cycle and across all of the Hs.

Idaho supports making hatchery life more like life in the wild. NMFS researchers have found that rearing fish in hatcheries with more natural habitat (rocks, stumps, logs, etc.) and rearing fish that fed on the bottom rather than on the water surface produce fish more adapted to survival in the wild. By converting hatcheries to closely mimic natural production, numbers of hatchery fish could be reduced, causing a reduction of competition with wild fish. Also, converting to volitional release at the hatcheries would reduce the glut effect of mass releases. A majority of hatcheries currently release by a given date.

For example, at Dworshak National Fish Hatchery 1.2 to 1.3 million steelhead smolts are released on a convenient date in the first two weeks of April. If the fish were allowed to leave when ready, they may be metered out from the beginning of March through the middle of May. If allowed to leave volitionally, each departing fish would be ready to migrate. As it is now, some fish are ready to migrate, some not, and some are over-ready. The result is that the mass of fish over-populate the tributary which depletes food. Additionally, wild fish not ready to migrate may do so anyway with the hatchery fish and/or hatchery fish released prematurely may not migrate and will residualize and become predators on wild fish later in the year.

Idaho supports the NWPPC's recommendations in its 1999 Artificial Production Review report to Congress. The Council will work with hatchery managers to modify hatchery operations to comply with Artificial Production Review (APR) policy recommendations. Marking of hatchery fish that pose a threat to ESA listed fish is necessary.

2. The Nez Perce Tribal Hatchery

Members of the Nez Perce Tribe and other residents of the Clearwater region of northern Idaho have moved one step closer to producing more salmon.

The project, sponsored by the Nez Perce Tribe, will include eight separate facilities: an incubation site at Sweetwater Springs; an incubation and release site at Tribal Allotment 1705; and five satellite release sites located at Cedar Flats, Lukes Gulch, Newsome, Yoosa/Camp, and North Lapwai Valley. The hatchery will produce spring chinook, late run fall chinook, and early run fall chinook for release in the Clearwater region of northern Idaho.

Plans for the facility received independent scientific review along with all projects proposed for implementation in the region's fish and wildlife program. The scientific review raised concerns about the effect hatchery fish may have on wild stocks.

After scrutinizing past scientific analysis of the Nez Perce proposal and reviewing its proposed environmental safeguards and monitoring and evaluation plans, an independent scientific review by Battelle Pacific Northwest Laboratory found that concerns about the project were fully addressed. The Council approved $2 million to complete the hatchery's final design, and $16 million for construction. Annual operation and maintenance costs after completion are estimated at about $2 million, with monitoring and evaluation expected to cost about $1.8 million annually. Construction of the hatchery began this past summer.

Three central issues dominate discussion of artificial production:

- The extent artificial production can be used to boost or conserve natural production of listed fish;
- how can mitigation hatcheries be best used to meet fishery objectives while minimizing adverse impacts to listed fish, and
- what is the proper balance and distinction between, and approach for, using hatcheries to support fisheries versus using hatcheries to supplement or conserve natural production. Idaho's recommended conservation measures relative to hatcheries are made in the context of these three issues.

PROPOSED HATCHERIES MEASURES

Hatcheries in General

- The use of hatcheries to provide harvest is recognized as a legitimate goal. However, hatcheries must be operated in a manner that avoids significant impacts on listed fish.
- Declining hatchery and non-hatchery stocks may require temporary shifts in some hatchery objectives and operations to aid conservation. In the short-term, as conservation hatchery techniques are developed and evaluated, existing hatchery facilities may be used as appropriate. As conservation hatchery techniques are refined, different facilities may be required to optimize effectiveness.
- The current hatchery system shall be operated to provide for a mix of production strategies and objectives.
- Make hatchery life more like life in the wild.
- Study/Implement volitional release.

Hatcheries as a Means to Conserve or Boost Naturally Spawning Stocks

1) Spring/summer Chinook

- Continue traditional juvenile supplementation utilizing local broodstocks in the upper Salmon River, Pahsimeroi River, South Fork Salmon River and Johnson Creek.
- Maintain traditional juvenile and adult supplementation utilizing non-local broodstocks in the Clearwater drainage, mainstem Yankee Fork Salmon River and Panther Creek.
- Continue captive rearing supplementation in the Lemhi River, East Fork Salmon River, and West Fork of the Yankee Fork of the Salmon River.

2) Fall Chinook

- Continue tribal supplementation in the Clearwater River and Snake River below Hells Canyon Dam.
- As adults return, investigate opportunities to develop local supplementation broodstocks.
- Reduce supplementation using Lyons Ferry Hatchery broodstock.
- Captive breeding supplementation in ongoing Oregon studies.

- Investigate opportunities to develop fall chinook supplementation and harvest mitigation programs specified in existing IPC settlement agreement.

3) Steelhead

- Continue tribal initiatives for traditional supplementation using non-local hatchery smolts in upper Salmon River, South Fork Clearwater River.
- Develop local broodstocks for traditional supplementation with smolts in some upper Salmon River tributaries, Little Salmon River, Middle Fork Clearwater River, and selected lower Clearwater tributaries.
- Continue tribal egg-box program in upper Salmon River.
- Develop an analytical approach to quantify the relative and absolute extinction risks for individual and aggregate populations within the Snake River ESUs. Use this information, in concert with research results from conservation hatchery programs, to indicate the risks and benefits of expanding conservation hatchery approaches into additional subbasins. Decisions should consider the level of uncertainty and demonstrated efficacy of conservation hatchery approaches, the extinction risk of target populations, the previous history of hatchery influence on target populations, and the desire to implement a suite of conservation approaches, including refuge areas, throughout the Basin.

Hatcheries to Conserve or Boost Naturally Spawning Stocks

- Pursue a balanced mix of conservation hatchery strategies to determine the most effective approaches and maximize benefits while minimizing risks. Select strategies based on conditions in target watersheds.
- Relatively aggressive approaches should be tested in areas where native stocks have been locally diminished or areas with extensive hatchery influence from non-local sources. More cautious use of conservation hatchery approaches can be tested in areas with previous hatchery influence and existing natural production of native fish.
- With local cooperation, certain watersheds should be maintained as wild fish refuges as a hedge against uncertainty inherent in artificial propagation, as well as “controls” for evaluating conservation hatchery efforts.
- Define success of conservation hatchery programs as maintaining or increasing natural production without reducing natural productivity.
- Continue ongoing or planned conservation hatchery programs, using an experimental approach to refine techniques and determine benefits and risks. Maintain a spectrum of strategies throughout the Columbia Basin to “spread-the-risk” and maximize learning, including traditional supplementation with juveniles and adults using local and non-local broodstocks, captive rearing, captive breeding, adult outplants, and egg-boxes.

Hatchery Management to Avoid Impacts on Listed Stocks

- Continue hatchery reforms designed to minimize adverse ecological impacts to listed fish.

- Maintain reduced levels of steelhead smolt releases in natural production areas designated through the ESA permitting process.
- Maintain restructured release locations of steelhead smolts designated through the ESA permitting process.
- Continue to only allow chinook releases from locally derived broodstocks in the Salmon River drainage, with exceptions for areas where native runs are diminished or mixed with non-local hatchery stocks.
- Continue implementation of hatchery practices recommended by the Integrated Hatcheries Operations Team and the Artificial Production Review.
- During interim, focus of local broodstock development from listed fish will be for conservation hatchery programs and not harvest-oriented programs.
- Make hatchery life more like life in the wild.
- Expand research for steelhead and chinook mitigation programs to evaluate actions and further reduce adverse ecological impacts.
- Ensure adequate funding for implementation of these measures.

D. HYDROPOWER (VOL. 2, P. 70)

IDAHO'S PERSPECTIVE:

> **FLOW AUGMENTATION FROM THE UPPER SNAKE RIVER BASIN HAS NOT BEEN SHOWN TO PROVIDE A BIOLOGICAL BENEFIT . MEANWHILE, AS THE DEBATE OVER DAM BREACHING HAS ENSUED, THERE HAS BEEN NO SIGNIFICANT CAPITAL INVESTMENT IN IMPROVING FISH PASSAGE AT THOSE HYDROPOWER PROJECTS.**

FOUR GOVERNORS RECOMMENDATIONS:

> **[F]EDERAL AGENCIES MUST DOCUMENT THE BENEFITS OF FLOW AUGMENTATION AND THE PRECISE ATTRIBUTES OF FLOW THAT MAY MAKE IT BENEFICIAL.**
> **[W]E SUPPORT FURTHER MODIFICATIONS TO THE CONFIGURATION AND OPERATION OF THE HYDROSYSTEM WHERE APPROPRIATE AND NECESSARY TO BENEFIT FISH AND SO LONG AS THE MODIFICATIONS DO NOT JEOPARDIZE THE REGION'S RELIABLE ELECTRICITY SUPPLY.**

1. The Scientific Basis For Flow Augmentation

In its biological opinions on operation of the FCRPS, the National Marine Fisheries Service has established spring and summer flow targets for the McNary, Priest Rapids, and Lower Granite projects.

NMFS has assumed that irrigation in the Snake River Basin and associated reservoir operations constitute a major impediment to meeting the flow objectives. However, this assumption is not supported by the best available scientific information.[84]

In a recent study, it has clearly been shown that during the time periods for which the National Marine Fisheries Service (NMFS) has set forth flow objectives, there has been no measurable declines in the magnitude or trends of average daily flows since 1916, the year when maintenance of flow records was initiated.[85]

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84. *See* State of Idaho's Comments *re*: Draft Biological Opinion On Operation of the Federal Columbia River Power System Including the Juvenile Fish Transportation Program and the Bureau of Reclamation's 31 Projects, Including the Entire Columbia Basin Project (Dated July 27, 2000) at 12-18.
85. Dreher, *supra* note 26.

Further, to the extent significant flow depletions had already occurred by 1916, those depletions could not have contributed to the declines in salmon populations since the 1950s into the 1960s, when the Plan for Analyzing and Testing Hypotheses (PATH) concluded that the productivity of Snake River salmon populations remained viable, unless the effects of the depletions were delayed for 50 years or more. Such delayed impacts are simply not credible.

Similarly, there have been no data that clearly demonstrates significant biological benefits from augmenting flows in the Snake River for any configuration of the FCRPS. NMFS has been using water from the Upper Snake River Basin in attempts to benefit out-migrating Snake River subyearling fall chinook salmon during the period June 21 through August 31. This has been based in part on data from passive induced transponder (PIT)-tag studies conducted by NMFS that showed an apparent correlation between flow and survival for hatchery-raised Snake River subyearling fall chinook salmon. Despite repeatedly being asked to quantify the biological benefits of flow augmentation and to identify which attributes of flow (e.g., velocity, temperature, turbidity) provide survival benefits, NMFS has been unable to do so.

In an effort to determine whether there is any significant correlation between velocity of flow and survival, IDWR and IDFG completed an analysis of the NMFS PIT-tag data.[86] The report concludes that survival and flow data, despite showing an apparent correlation between flow rates and survival, do not imply a cause-and-effect relationship between flow and survival of subyearling fall Chinook and, thus, should not be used as a basis to inform the flow augmentation debate. This is primarily because the experimental design under which these data were collected did not address other factors that appear to exert a strong influence on migration characteristics and survival.

Accordingly, available data does not show that augmenting Snake River flows to increase channel velocities enhances migration rates.

Future studies may be appropriate to resolve whether there is a survival benefit associated with increased turbidity or decreased temperature associated with higher flows. However, since the Hells Canyon hydroelectric power complex includes reservoirs that remove turbidity through settling, releases below Hells Canyon would be expected to be relatively clear on a qualitative basis. Consequently, flow augmentation from the Upper Snake River Basin would not be expected to result in higher turbidity. Similarly, water from the Upper Snake River Basin used for flow augmentation from June 21 through August 31 is relatively warm and cannot cool water in the lower Snake River.

To the extent there are survival benefits from cooler water released from Dworshak Reservoir, such benefits will be diminished by warmer water from the Upper Snake River

86. Karl J. Dreher, *et al.*, REVIEW OF SURVIVAL, FLOW, TEMPERATURE, AND MIGRATION DATA FOR HATCHERY-RAISED, SUBYEARLING FALL CHINOOK SALMON ABOVE LOWER GRANITE DAM, 1995-1998 (September, 2000). (Attached as Exhibit K.) This report is also being submitted with Idaho's comments to the FCRPS BiOp, and is incorporated herein by reference.

Basin released through Hells Canyon. Therefore, if cooler water temperatures provide significant survival benefits, flow augmentation from the Upper Snake River Basin for subyearling chinook salmon may, in fact, incrementally reduce survival.

While the above evaluation is largely qualitative, it highlights the fact that NMFS has been unable to quantify specific survival benefits from specific attributes of flow resulting from flow augmentation from the Upper Snake River Basin conducted since 1993. Thus, there currently is no basis for increasing flow augmentation from the Upper Snake River Basin.

2. Transportation

The National Marine Fisheries Service recently issued a Draft White Paper relating to transportation and concluded that:

- In most studies, fish that were barged or trucked through the lower Snake River dams survived better than in-river fish.
- One test of yearling chinook on the Snake River found that trucked fish return 5.8 times better than in-river, while barged fish return at a rate 8.9 times more. The researcher suggested more tests should be done because another study of steelhead and fall chinook showed no significant difference.
- The potential for delayed transport mortality will require further study.
- Straying is no more a problem with barged fish as with in-river fish and there is no evidence that increased straying of steelhead into the Deschutes River is a result of barging.
- Nearly every part of barging, handling and collecting, mixing wild and hatchery fish, releasing, causes stress.
- There is uncertainty about levels of post-transport and post-bypass mortality that should continue to be evaluated.

Idaho believes that given these recent conclusions, transportation should continue to be a part of an overall “spread-the-risk” policy. However, the hydropower performance standards make no mention of transportation for juvenile salmon.

3. Dam Modification

a) Overview

The U.S. Army Corps of Engineers Columbia River Fish Mitigation (CRFM) Program began in 1988. The purpose of the CRFM Program is to mitigate adverse effects of the federal dams on the Lower Snake and Columbia rivers on anadromous fish. The mitigation consists of fish passage improvements to the eight federal dams, to safely pass juvenile salmonids and to improve adult passage. The CRFM Program guided the needs of the listed Snake River populations identified by NMFS in the March 1995 Biological Opinion and NMFS 1998 Supplemental Biological Opinion for steelhead.

The System Configuration Team (SCT) was formed as a technical coordinating committee for the Corps and other federal agencies to coordinate the prioritization and implementation of projects or measures in the CRFM Program with other regional entities. Membership of the SCT includes the Corps, Council, NMFS, BPA, BOR, USFWS, and state and tribal fishery agencies. The SCT is co-chaired by NMFS and the Council.

On September 16, 1996 a Memorandum of Agreement was entered into among the departments of Army, Commerce, Energy and Interior concerning the BPA's financial commitment for Columbia River Basin Fish and Wildlife Costs. Funds to implement the CRFM Program measures are requested by the Corps in the federal budget process and are appropriated annually by Congress.

The SCT is currently working on a mainstem capital construction five year work plan (1996-2000). The work plan involves two fundamentally different approaches to address prioritization of spending roughly $600 million allocated to the Corps' General Construction Fund between 1997 and 2001 as provided for under the regional MOA. One of these approaches is referred to as the Federal/Council approach.

This approach suggests funding juvenile fish screening and bypass systems and associated facilities, transportation barges and associated improvements, and gathers necessary information from engineering feasibility and prototype studies related to implementation of drawdowns, dissolved gas abatement structures and surface bypass systems. The information gained will be used to determine the future implementation path for mainstem capital construction activities.

The current general goal of the CRFM Program for mainstem fish passage is for the Corps to implement all reasonable measures for the operation and configuration of the FCRPS that will reduce mortalities of listed fish (adults and juveniles). The biological objectives for mainstem passage are to minimize delays at dams and minimize the passage of fish through turbines by providing high survival alternative passage routes supporting salmon smolt-to-adult survival ratios that foster long-term population growth.

The interim objective for juvenile passage improvements is to achieve at least an 80% fish passage efficiency and a 95% survival rate for juvenile fish passing at each dam, while keeping total dissolve gas levels within the limits of state water quality standards under the Clean Water Act. The objective for upstream passage is to ensure a high degree of adult passage success by maintaining adult fish facilities and make facility improvements where necessary.

About 46% of the Program effort in FY 1999 was on Mitigation Analysis studies that include: a) surface bypass prototype construction, modeling and evaluations at Bonneville and John Day dams; b) completion of lower Snake River drawdown feasibility studies; c) gas abatement and spill studies; d) turbine passage survival studies; and e) additional adult fish passage studies.

The other 54% of the Program effort in FY 1999 was implementation of fish passage improvements including; a) continuing construction of Bonneville Dam juvenile fish bypass improvements; b) completing relocation of the bypass outfall; c) construction and prototype testing of new extended-length fish screens at John Day Dam; d) implementation of various adult fish passage improvements; and e) engineering design work on other fish passage improvements.

Idaho supports the CRFM programs as outlined in the 1995 Biological Opinion. In Addition, the recent COE FR/EIS study for the lower Snake River dams proposed the following modifications to the projects, all of which are supported by the State of Idaho:

- **New Turbine Cams**
  The cams that control the turbine blades and wicket gates may be modified to increase the hydraulic efficiency of the turbines which would reduce fish mortality.

- **Upgrade of the Lower Granite Juvenile Fish Facilities**
  Certain structural modifications and upgrades, including upgrades to the raceways and direct barge loading facilities, should be made to the Lower Granite facility to more effectively handle fish.

- **New Fish Barges**
  Additional barges will allow direct loading at fish collection facilities which will reduce the amount of fish handling and associated stress.

- **Adult Fish Attraction Modifications**
  The adult fish attraction water at selected dams should be modified in order to ensure an adequate water supply for the fish ladders in the event of a pump failure.

- **Modified Fish Separators**
  To reduce fish stress and delay, at existing juvenile fish facilities, new separators should be installed at Little Goose and Lower Monumental dams, in addition to an upgrade of the Lower Granite juvenile fish facility.

- **Cylindrical Dewatering Screens**
  Cylindrical dewatering screens should be installed at the Little Goose, Lower Monumental, and Ice Harbor facilities, and should be included in an upgrade of the Lower Granite facility.

- **Spillway Flow Deflectors/Pier Extensions**
  Additional spillway flow deflectors, modifications to existing spillway flow deflectors, and pier wall extensions should be added at the Lower Granite, Little Goose, and Lower Monumental facilities.

b) Projects and Measures Completed

Congress asked the NWPPC, with the assistance of the Independent Science Advisory Board (ISAB) to review the CRFM Program. The Council recommended that the Corps, NMFS and other regional entities who participate in the SCT forum to revise their decision making processes and criteria to be consistent with the principles, guidelines and ecosystem perspective outlined by the ISAB. Two biological principles are the dominant focus of passage decisions, first, protect biodiversity; and second, passage solutions that best fit natural behavior patterns and river processes are favored.

Ten common issues and corresponding principles described by the ISAB, and with concurrence of the Council, reflect further the twin themes of protecting biodiversity and favoring natural behavior patterns and river processes. The principles, supported by Idaho, are as follows:

1. Spill/Natural Behavior and River Processes. Juvenile passage alternatives should be evaluated against the baseline of spill. The biological baseline is 2% mortality in spill, followed by increasing in-river mortality when gas supersaturation is generated above 120%.
2. Site Specificity vs. General Biological Premises. A design process should be tested that meets the generic needs of fish first, and then adjusts the design to the specific characteristics of the dam secondarily.
3. Importance of Premises and Hypothesis. Explicit statement of biological premises is a valuable aid for efficient development of fish passage technologies.
4. Biodiversity. Strive to make dam modifications that will benefit the suite of species and stocks using the river system. Where designs are favoring one segment of the suite, multiple systems may be needed to include the other species and stocks.
5. Inconsistent Measures of Performance. A common "currency" of stock specific performance measure of system improvements.
6. Long-Term vs. Short-Term Goals. The long-term goal of adult returns must be kept in mind even as short-term remedies are proposed and built. Markedly new approaches must be developed and tested instead of minor adjustments to present technologies.
7. Scheduling Salmon Recovery Measures. In order to appropriately prioritize among projects, clear criteria based on biological needs for successful fish passage are required.
8. Passage Options Are Interrelated. Decisions about fish passage measures at a project should be made with all available alternatives clearly identified, and the interactions among alternatives explored.
9. Diversion v. Destination. Diversion technologies and destinations should not be linked in the pursuit of alternative configurations.
10. More Emphasis Needed on Adult Passage. Returning adults represent the survivorship of many thousands of initial smolts and they should be given higher priority than they have in the past.

c) Minimum Gap Runner Turbines

A Minimum Gap Runner (MGR) is designed to eliminate almost all gaps fish could enter when the hydropower generating turbine is operating. This is done by making the blades longer than those of traditional Kaplan blades, and milling out notches in the hub for the longer corners to fit into when the blades are tilted at a steep angle. The MGR is an efficient blade for power generation.

A conceptual design was developed by the Turbine Working Group (TWG), a regional group of technical experts working together on the Advanced Hydro Turbine System Program (AHTS). This group was created in 1994 by the U.S. Dept. of Energy (DOE) , Electric Power Research Institute (EPRI), and the Hydropower Research Foundation. The COE Hydroelectric Design Center developed the design requirements and the design was adopted and incorporated into the powerhouse major rehabilitation program by the Portland District. Voith Hydro built the prototype under contract to the Corps.

Under present conditions, estimates of fish survival through the turbine passage route vary from 89 to 94%. There are predictions of 1% to 4% improvement of survival. Even a 1% increase multiplied over eight Columbia-Snake dams would be significant. At a 4% improvement, survival rates with MGRs could range from 93 to 98%.

The first MGR installed in Corps projects on the Columbia-Snake system is at Bonneville's first powerhouse. The new design MGRs cost more than a standard design, but in some cases increased power generation may offset some of the additional costs.

Testing of the MGR at Bonneville Dam began November 11, 1999, and concluded January 1, 2000. Forty fish per day were released into the new MGR turbine chamber, forty into one of the old turbine chambers, and forty into the tailrace that did not go through a turbine. The study produced twenty-four survival estimates, one for each of the two turbines at four operating conditions with three release points. Fish were released to pass near the hub, at the mid-blade region, and near the blade tip. The fish were picked up in the water after the test and put into a tank for 48 hours to check for delayed mortality.

Preliminary analysis indicate that fish passed through the MGR had better survival overall than through the conventional unit. Overall injury rates among turbine-passed fish were low for both units , 1.5% and 2.5% for the MGR and Kaplan unit respectively. Survivals of fish passed near the hub were high (97% or greater) for both units. Survivals among fish passed through the mid- blade region ranged from 95 to 97% and did not differ between units. At all four power levels, the MGR showed better survival than the conventional units for fish that passed near the blade tip. Survivals for blade tip-released fish ranged from 90.8 to 95.6% for the conventional Kaplan and from 93.8% to 97.5% for the MGR.

The Turbine Passage Survival Program was developed by the COE in coordination with the TWG. It is a three year program to investigate short-term and long term improvements to juvenile passage through the turbine. The entire turbine environment is being studied. The project study plan was developed in coordination with related activities underway by other organizations (Public Utility Districts, DOE, EPRI, and BPA) to eliminate duplication, reduce cost and enhance the effectiveness of the Corps turbine program.

Idaho strongly supports continued research and testing of MGR turbines, with the goal of installation at all dams including the four lower Snake River dam projects upon retirement of original turbines. Congress should continue to fund this program.

d) Bypass Systems

Because fish must dive down 60 to 80 feet into turbine intakes to be guided by fish screens, then rise back near the surface of the bulkhead slot to enter the orifices, they are subjected to large pressure changes over short periods of time. This has led to the investigation of surface bypass/collector (SBC) systems. Since 1995, the Corps has been working on this technology at Lower Granite and Bonneville Dams. Results have improved as the test facilities have been evaluated and modified.

Three concepts are being evaluated at Lower Granite Dam for the Lower Snake River Feasibility Study. These include:

- A partial surface bypass collector in combination with an 1100-foot long steel curtain to guide fish diagonally.
- A SBC in front of all six turbine units.
- A curtain in front of all six turbines to deliver fish over the spillway.

Combined guiding efficiencies for these three concepts are 93%, 91% and 96% respectively. Therefore, not only would these systems have the potential to reduce the stress and delay to fish entering the screened bypass systems, but also, they would significantly increase the percentage of fish diverted around the dams with far less flow over the spillway than is occurring with the spread-the-risk operation of the fishery agencies. With dewatering systems added, these new concepts would also allow collection and transportation of fish or in river migration.

e) Turbine Screens

Turbine screen development began in the mid-1960s when NMFS was investigating ways of reducing turbine mortality at Ice Harbor Dam. A screen was designed which would be lowered into the bulkhead slot of the turbine intake, then tilted upward into the flow to deflect juvenile salmonids up the bulkhead slot. From there, they could egress out through orifices into the ice/trash sluiceway and be bypassed around the dam. The original screen had a metal mesh-like conveyor belt to carry fish and trash upward. The screen was as wide as the turbine intake roughly 20 feet long, and fished the upper 1/3 of the turbine intake. The fish were to swim up the bulkhead slot while the trash was to be washed off and go down through the turbine. This screen was tested in 1969.

In 1970, the Ice Harbor screen was modified and moved to Little Goose Dam. Early tests were conducted by releasing fish by hose in front of the screen. It was learned that another screen, the vertical barrier screen, would be required to keep fish diverted up the bulkhead slot from going back down through the gatewell slot into the turbine. Early research showed that the 6-inch orifices and imbedded pipe at Little Goose Dam were not safe for fish. Early screen tests evaluated mesh size and screen angle. As tests progressed, additional screens were acquired to strengthen the test results.

In 1975, Lower Granite Dam was completed, and the facility became the focus of screen testing. Fish screen tests moved there. A major change in screen design was conversion from hydraulically driven, metal mesh screens to electrically driven, plastic mesh screens with perforated plate to create a hydraulic cushion in front of the screen. Other tests included changing the design of vertical barrier screens to improve hydraulic conditions in the bulkhead slot, fine-tuning the gap, throat, and overlap of the fish screens, adjusting the height of the screens in the bulkhead slots, and raising or removing operating gates to increase fish guiding efficiency.

Screen research also began, in the mid-1970's, at McNary Dam, and at Bonneville Dam. Stainless steel wedgewire screens were tested in comparison with traveling fish screens. However, this design was abandoned for lack of a satisfactory way to clean the screens. Screen development in the late 1970's culminated with installation of standard length submerged traveling screens (STSs) at Lower Granite, Little Goose, McNary, and Bonneville Dams.

Screen research continued through the 1980s as fish protection was sought at John Day, The Dalles, Lower Monumental, and Ice Harbor Dams and at Bonneville Second Powerhouse. These dams were subsequently equipped with STSs except that at the Dalles, only test screens have been used.

The next major breakthrough came in the 1990s with the development of extended fish screens. Forty feet long, these screens were to fish the upper 2/3 of the turbine intake. Extended submerged traveling screens (ESTSs) were tested as were extended submerged bar screens (ESBSs). Tests of extended screen technology started at Lower Granite Dam in 1990 and was expanded to McNary, Little Goose, The Dalles, Bonneville, and eventually John Day Dam.

Over the years, fish guiding efficiency (FGE or the percentage of fish entering the turbine intake that are guided by the fish screens) has increased from 2 to 4% in the old imbedded fish bypass systems at John Day, Lower Monumental, and Little Goose Dams (without fish screens) to high 70s% to low 80s% for spring summer chinook and the high 80s% to mid 90s% for steelhead. The FGE for subyearling chinook salmon has remained much lower, generally less that 60%.

f) Collectors

ICE HARBOR: Juvenile fish facilities were not installed at Ice Harbor when it was built in 1961. In 1965, juvenile salmonids were discovered collecting in bulkhead slots and gatewells. In 1967, six inch orifices were drilled from the bulkhead slots to the ice/trash sluiceway, and about 2 to 4% of the fish entering turbines were bypassed from turbine intakes to the tailrace of the dam. This was the origin of the bypass concept used at most Corps dams today.

Starting in 1965, juvenile fish collected at Ice Harbor were marked and transported below Bonneville Dam by NMFS to determine if that was a viable method of avoiding turbine and reservoir mortality at downstream dams. Seeking ways to prevent fish from going into turbines, the NMFS came up with the concept of the submerged traveling fish screen. The first screen was tested at Ice Harbor in 1969.

In 1970, screen research moved to Little Goose Dam. Until the late 1970s, juvenile fish passage was provided by the orifices and sluiceway. In the early 1980s, sluice gates were opened to divert additional fish from the forebay. Experiments were conducted from 1982 through 1984 to fine-tune the sluicegate operation and by 1984, the system was operated with 53% of the juvenile fish diverted before they could enter turbine intakes.

Falling lower on the Columbia Juvenile Fish Mitigation Program priority list, Ice Harbor juvenile fish facilities were not upgraded until 1996. In 1995, standard length fish screens were installed and fish were temporarily routed to the ice/trash sluiceway by new 12-inch orifices. By 1996 a new collection flume and dewatering facility were completed in the ice/trash sluiceway and a non-pressurized flume was constructed to a sampling laboratory below the dam. All fish are bypassed to the tailrace.

LOWER MONUMENTAL: Juvenile fish facilities were installed when Lower Monumental was constructed in 1969. An embedded pipeline and orifices were installed as an economic replacement of the ice/trash sluiceway concept that had been developed at downstream dams.

The imbedded pipe concept was developed for John Day and was utilized at Lower Monumental and Little Goose Dams. This system, along with spill for fish passage ,was used until 1992. In 1991 and 1992, a new juvenile bypass tunnel was excavated the length of the Lower Monumental powerhouse, a non-pressurized bypass flume, fish sampling laboratory, holding raceways, and truck barge loading facilities were constructed. Standard fish screens were installed in 1992.

LITTLE GOOSE : When Little Goose was constructed in 1970, juvenile fish facilities included a John Day -style imbedded pipeline. Six inch orifices guided fish into the 3 feet. diameter pipe. When fish screen research moved to Little Goose in 1970, it immediately became apparent that the imbedded pipeline was inadequate to handle the numbers of fish diverted by screens, and because the orifices or pipeline could be blocked by debris, descaling and mortality rates through the system were high.

Following successful construction of a tunnel bypass system at Lower Granite in 1975, studies began on replacing the imbedded pipeline at Little Goose. A tunnel was mined in 1978-79, and a new facility became operational in 1980. A full complement of fish screens was installed in 1981.

However, problems with the pressurized pipe bypass to the laboratory and truck/barge loading facilities required further modification. High mortality and gas supersaturation problems required shutting the system down in 1983. The pipeline was modified to reduce mortality and gas problems in 1984, but there was still concern about the facility.

With the Columbia River Juvenile Salmon Mitigation Program initiated in 1987, replacing the Little Goose facility was highest priority. Tests of open flume concepts in 1985 and 1987 led to a major change in design. A new, no-pressurized flume with most of the water removed at the dam was used to deliver fish to a new laboratory handling and loading facility below the dam. This flume eliminated the gas supersaturation problem, and reduced stress and mortality to very low levels. The latest improvement to the system was installation of extended fish screens in 1997, which increased fish collection to 10 to 15%.

LOWER GRANITE: When Lower Granite was constructed in 1975, juvenile fish facilities included a tunnel cast into the powerhouse. Eight-inch orifices from each bulkhead slot bypass fish into the tunnel. At the request of NMFS, fish screen slots were installed upstream from the tunnel, but putting the screens further forward in the turbine intakes soon proved unsuccessful.

Fish transport research which from moved to Lower Granite in 1975 continued there, at Little Goose Dam, and at McNary Dam up to 1980. Extreme drought in 1977 prompted the fishery agencies to request barge transport for the first time. Two barges were modified for that purpose, and temporary dock and loading facilities were provided at Lower Granite. In 1978, a full installation of fish screens increased fish collection, and two Army surplus barges were made part of the permanent equipment.

Many modifications have been made to the collection facilities over the years. These include enlarging the orifices, replacing temporary lab facilities with modern, permanent facilities, addition of raceways to expand holding capacity, upgrading plumbing and electrical systems, installing PIT tag detection and diversion equipment, upgrading laboratory facilities and expanding holding capacity, installing a roof over the west raceways and separator, and improving truck and barge loading facilities. Barges were added in 1980, 1981, 1989, and 1998 bringing the present total to eight.

Following several years of research, extended fish screen technology was installed at Lower Granite in 1996. Although the pressurized pipe from the tunnel to the holding facilities has been identified as a major concern, several years of over 99.5% survival through the facility prompted placing replacement of the Lower Granite facilities last on the Columbia Basin Juvenile Salmon Mitigation Program priority list. The facility was scheduled to be replaced in 1996, then 1998, and following a recommendation by the regional fishery agencies, has been postponed until after the Lower Snake River Feasibility Study is completed.

g) Fish Ladders

ICE HARBOR: When Ice Harbor Dam was completed, adult fish facilities consisted of a fish ladder on the south shore to pass fish over the dam that were collected by the south powerhouse entrances, north powerhouse entrances, and floating orifices gates across the downstream face of the powerhouse. Eight 250 horsepower (hp) electric pumps provided 2,000 cfs of auxiliary water to attract fish into the collection system. The ladder was 24 feet wide and used 75 cubic feet per second (cfs) flow. On the north shore, a 16 feet wide 1:10 slope ladder flowing 75 cfs was installed. Three 200 hp pumps provide 750 cfs of auxiliary water to attract fish from the north side of the spillway.

Both fish ladders were constructed with flash-board type fish counting stations. These were upgraded in the 1970s. The fish ladders were also modified for energy conservation (partial non-overflow sections were added to the weirs), and to allow shad passage in the 1970s (orifice control sections were replaced with slot control sections).

LOWER MONUMENTAL: When Lower Monumental was completed, adult fish facilities included a fish ladder on each side of the dam. These ladders are 16 feet wide and utilize 75 cfs each. The north ladder receives fish from two south powerhouse entrances, floating orifices gages, and two north powerhouse entrances. Attraction water is provided for both fish ladders by three turbine pumps that provide up to 2,550 cfs flow.

Water is passed to the south fish ladder by a tunnel under the spillway. Originally, the north counting station was a submerged window counting station, one was a flashboard station. The south counting station was converted to a submerged window station in the mid-1970s.

LITTLE GOOSE: When Little Goose was completed, adult fish facilities included a single fish ladder on the south end of the powerhouse. Adult fish are directed from the north side of the spillway into a collection tunnel under the spillway that ties into the powerhouse collection system. Two main entrances at the north and south ends of the powerhouse, and floating orifice gates across the powerhouse, also allow fish to enter the powerhouse collection system. Fish are directed into a fish ladder that is 16 feet wide and flows 75 cfs. Three turbine pumps provide 2,550 cfs auxiliary flow to the collection system. A single, submerged fish counting window and visitor viewing area is provided. Minor modifications have included reduction of the number of orifice gate openings, and installation of guidance fences to prevent fallout as fish swim past the entrances as they progress toward the fish ladder.

LOWER GRANITE: Adult fish facilities include a single fish ladder on the south end of the powerhouse. Adult fish are directed from the north side of the spillway into a collection tunnel under the spillway that ties into the powerhouse collection system. Two main entrances at the north and south ends of the powerhouse, and floating orifice gates across the powerhouse, also allow fish to enter the powerhouse collection system. Fish are directed into a fish ladder that is 16 feet wide and flows 75 cfs. Three electric pumps provide 2,100 cfs auxiliary flow to the collection system. A single, submerged fish counting window and visitor viewing area is provided.

Minor modifications have included reduction of the number of orifice gate openings, and installation of guidance fences to prevent fallout as fish swim past the entrances as they progress toward the fish ladder.

PROPOSED HYDROPOWER MEASURES

Flow Augmentation

- No Idaho water shall be dedicated for flow augmentation except as pursuant to state law.

Transportation

- The success in survivability due to trucking and barging warrants that the program be continued while additional transportation research is conducted.

Minimum Gap Runner Turbines

- Research and testing of Minimum Gap Runner (MGR) turbines should continue at Bonneville Dam with the goal of installation at the four lower Snake River dam projects upon retirement of original turbines.
- Congress should increase the funding for the MGR program.

Dam Modifications

- Bypass systems, turbine screens, fish collectors and fish ladders should be improved at all of the four lower Snake River dams as soon as possible.
- Pit tag detectors at all dams.

EXHIBITS

EXHIBIT A - RECOMMENDATIONS OF THE GOVERNORS

RECOMMENDATIONS OF THE GOVERNORS OF IDAHO, MONTANA, OREGON AND WASHINGTON FOR THE PROTECTION AND RESTORATION OF FISH IN THE COLUMBIA RIVER BASIN

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July, 2000

Recommendations of the Governors of Idaho, Montana, Oregon and Washington for the Protection and Restoration of Fish in the Columbia River Basin

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Recommendations of the Governors of Idaho, Montana, Oregon and Washington for the Protection and Restoration of Fish in the Columbia River Basin

I. INTRODUCTION

Almost two decades after Congress passed the Northwest Power Act and nearly a decade after the first Endangered Species Act (ESA) listings of fish in the Columbia River Basin, state and federal agencies and Indian tribes have not agreed on a long-term, comprehensive, effective and coordinated approach to protecting and restoring fish of the Columbia River Basin, particularly salmon and steelhead. Individually and collectively, we governors have the authority to contribute to the efforts currently under way to develop an integrated, regionwide approach to fish recovery.

We acknowledge a broad regional responsibility to protect fish and wildlife species. Such an effort is under way through the Northwest Power Planning Council's (Council) fish and wildlife program amendments. As currently envisioned, the Council's program should be an important preventive component because wise management will help the region avoid future ESA listings.

Because of the work of the last 10 years, including research and on-the-ground efforts, there is regional support for many key elements of fish recovery. In this document, we express our support for these elements as the nucleus of a regional approach to the recovery of ESA-listed aquatic species, particularly salmon and steelhead.

We want to stress that while we intend the consensus recommendations contained in this document to be useful advice and guidance to decision-making entities such as the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service, Environmental Protection Agency and the Northwest Power Planning Council, our recommendations do not constitute a plan that can substitute for the procedural and substantive planning requirements of the Endangered Species Act, Clean Water Act, Northwest Power Act, or other relevant state and federal laws.

We are keenly aware of the extent to which breaching the four lower Snake River dams has become a polarizing and divisive issue. Regardless of the ultimate fate of the dams, the region must be prepared in the near term to recover salmon and meet its larger fish and wildlife restoration obligations by acting now in areas of agreement without resort to breaching the four dams on the lower Snake River. In order to succeed, the region must have the necessary tools including a clear and comprehensive plan, adequate time, and sufficient funding. Our recommendations address some of those necessary tools.

II. KEY ELEMENTS OF A REGIONAL APPROACH

A successful approach to recovery of salmonids and other aquatic species must include a clear goal, objectives that describe and measure the environmental and biological improvements needed to meet the goal, and an aggressive series of explicit strategies and actions designed to achieve the goal.

The approach must address the so-called "Four Hs" of human activities that influence fish and wildlife survival -- habitat, hydropower, harvest and hatcheries and also account for what we call the "Fifth H" -- the impact of these actions on humans. Strategies and actions must be biologically sound, economically sensitive, and sufficiently flexible to accommodate alternative approaches depending on what works best. Finally, the approach must be truly coordinated, in the sense that it must account for and successfully integrate salmon recovery efforts ongoing at the federal, regional, state and local levels.

With these features, this approach will have the public support needed for effective implementation.

RECOMMENDATIONS

Goal

The regional approach must include a clear goal so that, in short, the region can understand what constitutes success. Accordingly, the goal we suggest is protection and restoration of salmonids and other aquatic species to sustainable and harvestable levels meeting the requirements of the Endangered Species Act, the Clean Water Act, the Northwest Power Act and tribal rights under treaties and executive orders while taking into account the need to preserve a sound economy in the Pacific Northwest.

Objectives

The approach must include objectives geared toward accomplishing this goal. Objectives may be qualitative or quantitative. One qualitative objective should be a healthy, functioning ecosystem. In practical terms, this means that we prefer to benefit salmon through strategies and actions that emphasize and build upon natural processes. While we recognize this may not always be feasible, we think it is an important policy decision that will, in turn, clarify the region's choice of strategies and allow us to make most effective use of our finite financial resources.

It is our understanding that, at least in the federal biological opinion and "All-H Paper" soon to be issued, quantitative objectives, also known as performance standards, will play an important role. The creation and use of performance standards will be critical -- both in terms of allowing the region to move forward with specific strategies and actions and in measuring their success in achieving the desired environmental and biological improvements. Three criteria can ensure that performance standards are used appropriately:

- Performance standards must be grounded in the best available science. This means the standards must be technically valid as a measure of the success of actions taken to achieve salmon recovery. To that end, we recommend performance standards be subject to scientific peer review.
- Performance standards must be reasonably attainable. This means the standards must be clearly described, measurable and administered by a clearly designated entity with responsibility for compliance. This also requires that the actions to achieve the standards must be adequately funded in order to assure they can be implemented in a timely fashion.
- Performance standards must be implemented in a manner that coordinates the short-, mid- and long- term actions that are necessary to improve overall salmon recovery. Standards focused on near-term measures should describe the immediate on-the-ground actions that benefit fish. Mid-term standards should describe the success of the on-the-ground actions, and long-term standards should describe the overall success in achieving the desired biological response or improvement. Additionally, long-term standards should be crafted, wherever possible, in such a way that if improvement is not achieved, the performance standard would be useful in identifying the problem.

III. HABITAT REFORMS

In addition to the mainstem areas altered and blocked by dams, many key tributaries of the Columbia have inadequate flows for fish, impaired water quality, barriers to fish passage, unscreened water diversions or degraded riparian habitat. With Snake River and other dams in the Federal Columbia River Power System remaining in place, systemwide habitat improvements that respect private property rights, focused particularly in the tributaries and the estuary, become an even more critical component of salmonid and aquatic species recovery.

RECOMMENDATIONS

Partnerships

Because much of the habitat is on non-federal lands, state, tribal and local governments, as well as private landowners, must be full partners in the recovery effort. To date, the National Marine Fisheries Service has not been clear with these entities about the specific improvements needed for recovery and has not conducted regular discussions about how to address issues of mutual concern. We are disturbed by this lack of full partnership in what should be a collaborative effort. As one step to achieve greater collaboration, we recommend the President designate one official in the region to oversee federal agency fish recovery efforts in the Columbia River Basin and serve as the regular point of contact with the states, local and tribal governments.

Water for Fish

Stream and river reaches throughout the Columbia River Basin have flow and water quality problems that impede regional fish recovery efforts. The states are setting water quality standards and preparing implementation plans in accordance with previously established schedules. The states are also reviewing instream flow levels to address biological requirements for ESA-listed aquatic species. We are concerned, however, that the timelines for these tasks be fully consistent with the timeline required for salmon recovery. Therefore, we recommend federal assistance and support be made available to the states to better coordinate these timelines and, where necessary, to accelerate water quality improvements and to establish instream flows that benefit listed aquatic species in the Columbia Basin.

We support voluntary exchanges to obtain needed water for fish and support the development of water markets to effect exchanges among willing buyers and sellers. We believe this strategy has potential to contribute to fish recovery, and we are committed to support changes in state law or policies to facilitate this approach. We also recognize existing efforts to conserve water and support further assistance to promote conservation.

Protecting and recovering salmonids and other aquatic species requires protecting land on and around fish-bearing streams. Building upon successes elsewhere, we endorse creation of salmon sanctuaries that protect key aquatic habitats and related uplands through voluntary conservation easements, leases, land purchases, and tax-incentive donations. The region should attempt to obtain substantial additional habitat protections in the locations that promise the greatest benefits for fish.

Finally, given the major responsibilities that will fall upon private landowners, voluntary habitat improvement programs need to be fully encouraged through the use of a federally funded incentive program. Increased riparian fencing is an obvious place to start.

Local Recovery Plans

We strongly endorse the concept of local planning for recovery of salmonids and other aquatic species. This concept has the advantage of bringing together local and tribal governments with local citizens to develop and implement local recovery plans. A local focus also helps avoid duplication of efforts and "top-down" planning. Recovery plans developed at the local level, whether through state salmon plans, federal agency actions or through the Council's process, must be complementary. The federal government has a fundamental obligation to assist local efforts in developing fish recovery plans. A premium should be placed on implementation of those plans that meet requirements of the Endangered Species Act, the Clean Water Act and the Northwest Power Act.

To assist the local planning effort, we recommend that state authorities designate priority watersheds for salmon and steelhead and that plans for these watersheds be developed by October 1, 2002. Plans for all watersheds in the Columbia River Basin should be developed by 2005.

We request that by January 1, 2001, the Council provide a report to the states detailing how the Council's amended fish and wildlife program has addressed the necessary integration of federal, state and regional planning processes. Bonneville funding must be integrated with other funding sources for state and federal recovery initiatives, and the Council should address this issue in its report as well.

Fish Passage

In the Columbia River Basin, over one-half of the original habitat area for salmon and steelhead has been blocked by mainstem and tributary dams. The largest losses occurred from the construction of the dams within Hells Canyon and by Chief Joseph and Grand Coulee dams on the upper Columbia.

For the mainstem Columbia and Snake rivers, we must focus not only on currently accessible habitat, but also look for opportunities to increase the current level of habitat access with all dams remaining in place. A recent study by the Battelle Pacific Northwest National Laboratory and the U.S. Geological Survey (USGS) found a substantial percentage of the historic mainstem riverine habitat for Snake River fall chinook still remains unimpounded upstream of the Hells Canyon complex. Although there is still riverine environment where fall chinook historically spawned, it may not be capable of supporting fish today because of degraded quality. It must be better understood whether the present quality of the historic habitat is capable of supporting a self-sustaining population of fall chinook above the Hells Canyon complex. The feasibility of reintroduction, including an evaluation of the existing habitat, is being investigated as part of the Federal Energy Regulatory Commission (FERC) relicensing process for the Hells Canyon complex. While mindful of the challenges involved, options and costs should continue to be assessed as part of the relicensing process. A similar challenge confronts reintroduction of migrating salmonids above Chief Joseph and Grand Coulee dams, particularly above Grand Coulee. Nevertheless, we encourage work currently under way to assess the possibility**.**

Each state commits, by October 1 this year and annually thereafter, to provide a list of priority fish passage projects to the Council for proposed funding. The list could include such things as screening diversions and replacing culverts, as well as removal of, or passage at, tributary dams, as is being done at Condit, Wapatox and Marmot dams.

Estuary

The lower Columbia River estuary has come into focus as a vitally important component of salmon recovery. The region is fortunate that a water quality and fish and wildlife habitat plan has been developed by the Lower Columbia River National Estuary Program (NEP). This plan has identified actions to inventory those habitats critical for salmon health, as well as measures to protect or acquire such habitats. We believe that the federal government must immediately engage the states, tribes and local governments in implementing the NEP plan for the lower Columbia River estuary, including creation of the salmon sanctuaries referenced above.

Predation

The legitimate, but disparate, focus of varying federal laws, including the Endangered Species Act, the Migratory Bird Treaty Act and the Marine Mammal Protection Act present management challenges as we seek to protect ESA-listed juvenile and adult salmon and steelhead that, in turn, are prey for the birds and mammals also protected by these laws. We support actions to improve the coordination among these laws so that they are not working at cross purposes.

We recommend that the U. S. Army Corps of Engineers (Corps), NMFS and the Fish and Wildlife Service develop a long-term management plan to address predation by fish-eating birds and marine mammals. The relocation of Caspian terns within the estuary was a good start but is not sufficient by itself. The number of Caspian terns, as well as that of double-crested cormorants, should be significantly reduced in the Columbia River Estuary. The Caspian tern predation rate on juvenile salmon and steelhead remains unacceptable, as is the inability of the federal agencies to agree upon a common approach and a lead agency status for this effort. We recommend that such an approach be presented to the region by the appropriate federal agencies by the end of the year.

As part of the long-term management strategy for seals and sea lions, we recommend congressional approval of NMFS's proposal to acquire additional authority to take seals and sea lions that persistently impact listed salmonid species.

The Ocean

Recent studies and salmon returns suggest that ocean habitat is a significant factor influencing salmon survival. NMFS should work with the region to conduct an intensive study to address the role of the ocean in fish recovery, including the relative impact on fish mortality due to ocean predation, lack of food sources, temperature problems and harvest regimes. In addition, management of fish in freshwater should reflect new information about the ocean as it is developed. For example, it may be necessary to adjust hatchery production based on a better understanding of changes in ocean carrying capacity.

Interior Columbia Basin

Fully 50-60 percent of the land area in the Columbia River Basin is owned or managed by the federal government, including major headwater areas so important for fish. We believe modifications to management practices on these lands is essential to salmon recovery.

To assure these needed modifications occur, the interior Columbia River Basin needs a balanced strategy that can provide for stable and predictable multiple-use management on federal lands for fish and wildlife and other purposes while permitting needed flexibility, particularly on private lands. The existence of such a strategy is long overdue, and we urge Congress and the Administration to work with the region to have the strategy in place by year's end.

IV. HYDROELECTRIC SYSTEM REFORMS

Dams on the Columbia and Snake rivers provide energy, flood control, transportation, recreation and irrigation benefits to the people and economy of the Pacific Northwest. At the same time, construction and operation of the dams altered the ecosystem in which the once-great fish runs of the Columbia River Basin evolved.

RECOMMENDATIONS

Capital Improvements at Dams

We acknowledge that the Columbia and Snake River hydropower system has been improved for fish passage. Nonetheless, the dams continue to adversely affect fish survival. Therefore, we support further modifications to the configuration and operation of the hydrosystem where appropriate and necessary to benefit fish and so long as the modifications do not jeopardize the region's reliable electricity supply.

To benefit salmon migrants, both upstream and downstream, expedited schedules should be established to design and install passage improvements.

Priority capital improvements must also include those necessary to address water quality issues relating to both temperature and dissolved gas. All capital improvements should benefit the fullest range of salmonid species and should offer demonstrated biological gains. Uncertainty regarding the long-term status of the four lower Snake River dams should not preclude making passage improvements at those four facilities.

Transportation of Juvenile Salmon and Steelhead

Consistent with our preference to emphasize and build upon natural processes, we believe strategies and actions should be implemented that provide the best possible survival for fish that migrate in the river through the reservoirs and past the dams. We recognize that in the short term there are survival benefits from continuing to use fish transportation as a transitional strategy. However, we believe that when ongoing research affirms that survival of listed salmon populations would increase from migration in an improved river environment, an increasing number of juvenile fish should then be allowed to migrate inriver. An immediate evaluation is also necessary of survival rates for fish transported by trucks compared to barges. If survival is lower in trucks and barging is an available alternative, then trucking should be discontinued.

Spill

We recognize the need to improve the riverine character of the mainstem Columbia and Snake rivers as a means of further improving successful salmon migration, spawning and rearing. Spill is important in this regard.

Spill is recognized as a highly effective means of passing juvenile salmon downstream, reducing the mortality associated with passage through many turbine sets and in most bypass systems. The use of spill should be improved -- in duration, timing and quantity -- at all the federal hydropower projects. Experiments testing spill benefits at different levels and times of year should be expanded, and the impacts on juvenile fish survival from these alternative spill operations, including summer spill, should be carefully monitored and evaluated.

Flow

Flow management in the Columbia and Snake mainstems should continue as part of the mainstem strategy. Flow augmentation pursuant to state law, a key component of flow management, remains controversial. But there are ways to reduce the controversy in the future. First, federal agencies must document the benefits of flow augmentation and the precise attributes of flow that may make it beneficial. Second, where the benefits of flow augmentation have been documented, migrating fish should be left in the river to benefit from it. Third, the region should review off-river storage for additional water if flow augmentation is going to continue to be a key strategy. Fourth, flow management should be designed to integrate all water-related statutory mandates, including not only the Endangered Species Act but also the Clean Water Act, and should consider impacts to non-anadromous listed and unlisted species. Fifth, implementation of flow management should fully account for actual water conditions so that, for example, if cool water is provided for temperature benefits, the benefits are not negated by simultaneous releases of warmer water from other sources. Sixth, additional water may be available for flow augmentation if flood control operations can be prudently altered. The Corps and NMFS should work with the region on a study to determine whether flood control rule curves can be reconfigured to allow shaping of flows to improve survival of migrating salmon and steelhead. Finally, the region should explore whether salmon benefits could be achieved through cooperative agreements regarding power peaking operations, such as those currently in place for the Hanford Reach stocks and listed chum salmon spawning below Bonneville Dam.

V. HARVEST REFORMS

Salmon fishing has decreased to a level that represents a mere fraction of what once occurred. We commit to support a recovery approach designed not only to achieve ESA delisting levels but also to rebuild the runs to levels that support treaty and non-treaty harvest. But we believe rebuilding requires that all harvest may have to be reduced in the short term, together with aggressive actions taken to address mortality in the other life stages.

We respect the legal status and cultural importance of Indian treaty fishing rights. Changes in harvest management suggested below must be developed in partnership with the treaty tribes so they are consistent with the ongoing harvest and production litigation under *U.S. v. Oregon*, and also with federal and state governments to comply with the Pacific Salmon Treaty.

RECOMMENDATIONS

Ocean Harvest

The United States and Canada have signed a 10-year Pacific Salmon Treaty that, for the first time, implements an abundance-based ocean harvest regime for chinook and coho salmon. The agreement places special emphasis on further restrictions for fisheries that incidentally harvest weak stocks, and on getting the required number of fish onto the spawning grounds. We agree that this is a critical first step in the overall management of Columbia River stocks, and we recognize that the increased complexity of the management regimes to carry out the intent of the Treaty will require additional funding.

Given that long-term, biologically based management for the ocean is now in place, other steps can be explored to reduce ocean impacts on listed fish through use of more selective fishing techniques and a license buyback program that can reduce the current excess fishing capacity. Additional opportunities may exist to align viable fisheries with the opportunities available through a license buyback program given the excess fishing capacity that currently exists.

Finally, a random-observer program is needed to ensure the collection of information necessary for managers and the industry to reduce salmon bycatch mortality.

Columbia/Snake Mainstem Harvest

We support continuing current levels of tribal ceremonial and subsistence harvest. For commercial and non-treaty sport fisheries, we recommend that harvest rates, gear and timing in the mainstem fisheries be consistent with ensuring survival of the species and providing for their eventual recovery when combined with recovery actions in other sectors.

This means that harvest rates must ensure sufficient escapement to rebuild declining stocks. With inriver harvest rates ranging up to 31 percent for one of the listed stocks, we are not convinced that current practices are compatible with rapid recovery.

To achieve these reductions, we support increasing the selectivity of mainstem harvesting by exploring further gear, timing and location restrictions. The region must initiate research to better understand migration timing and movement of individual stocks to develop better selective fishing techniques.

Financial incentives must be broadened beyond selective fisheries to include economic incentives to reduce impacts to listed stocks, financial assistance for developing "value-added" fishery-related industries and mitigation of economic impacts to fishing-dependent communities.

Finally, hatchery operations must be modified so that excess fish are not being produced for fisheries where they cannot be harvested because of the impacts on weak stocks. Harvest goals must be linked to fish production goals. We expect state, federal and tribal fish agencies to produce a long-term production and harvest plan that protects ESA-listed fish. To that end, we call for a new Columbia River Fish Management Plan to be agreed upon in time for the spring 2001 salmon fishery.

Terminal Fisheries

As another important means of achieving the mainstem reductions described above, as well as replacing lost mainstem fishing opportunities, fisheries should be established in terminal areas below Bonneville Dam and in Zone 6, similar to those currently taking place in Oregon's Youngs Bay. Commercial harvest opportunities would target the hatchery-produced stocks returning to terminal areas. Reformed hatchery programs, which we address elsewhere in this document, could include establishing these terminal fisheries.

Law Enforcement

The region's fisheries law enforcement program should be strengthened to ensure accountability and to reduce illegal catch. Increased law enforcement should be concentrated and coordinated with habitat strategies to aid specific watersheds. We recommend this be accomplished through appropriate tribal, state and federal law enforcement programs.

Control Competitor Species

We recommend changing existing sport fishing restrictions to concentrate on species that prey on, and compete with, salmon for food, including northern pikeminnow. Sport fishing regulation changes also should strive to minimize effects of exotic species on native species. The region could experience short-term benefits from increased fishing opportunities for these competitor species.

VI. HATCHERY REFORMS

Since as long ago as the late 1800s, fish hatcheries have been seen as a tool to use in rebuilding fish runs decimated by overfishing or, in more recent times, as a means of producing large numbers of fish to support commercial harvest to mitigate the impact of dams. Yet our region's experience demonstrates that past hatchery practices have contributed to the decline of naturally spawning fish populations, as hatchery stocks increased while the naturally spawning component of the runs continued to decline.

It is time to recognize that hatcheries are used for multiple purposes, primarily producing fish for harvest but also for rebuilding naturally spawning populations through the technique of supplementation and for captive broodstock experiments. Careful thought must be given to how these techniques could maximize the efficiency of fish production to provide treaty, sport and commercial harvest opportunities while also protecting and rebuilding unique fish populations and complying with existing laws and legal processes, such as the *U.S. v. Oregon* litigation.

RECOMMENDATIONS

Implement the Artificial Production Review

The outline for redirecting artificial production of fish in the Columbia River Basin hatchery program is contained in the Council's recommendations in its 1999 Artificial Production Review report to Congress. We support these recommendations to significantly modify hatchery management practices among all federal and state salmon and steelhead hatcheries in the region.

To begin this process of reform, we recommend all hatcheries in the Columbia River Basin be reviewed within three years to determine the facilities' specific purposes and potential future uses in support of fish recovery and harvest. The Council should identify priority hatcheries that need expedited review and complete the reviews within eight months so that modification of hatchery operations can commence by January 1, 2001. Funding for hatchery reforms must be a joint federal, state and Bonneville responsibility. We recommend that, regardless of the funding source, future hatchery funding decisions take into account consistency with Artificial Production Review reforms.

Develop a Comprehensive Plan for Artificial Production

Consistent with the Artificial Production Review, the region's fish managers and tribes should jointly develop a comprehensive supplementation plan that includes aggressive monitoring and evaluation. We commit state agencies to work with tribal fish managers to develop such a plan. The plan should specify watersheds that can be used for supplementation, and also recommend respective tribal, state and federal roles in implementation of the supplementation plan. We support the concept that certain watersheds, with local cooperation, should be maintained as wild fish refuges as a hedge against uncertainty inherent in artificial propagation, as well as a “control” for evaluating conservation hatchery efforts.

We anticipate this plan would be part of the renegotiated Columbia River Fish Management Plan.

Fish Marking

To facilitate a robust harvest program for hatchery fish in a way that does not impact wild fish, we endorse a program that results in the marking of hatchery fish that pose threats to ESA-listed fish, to the fullest extent consistent with the Pacific Salmon Treaty. We also urge tribal, state and federal fish managers to put such a program in place promptly, as it will be difficult to implement many improved harvest techniques until it is possible to identify hatchery-reared fish.

VII. FUNDING AND ACCOUNTABILITY

Since 1980, the use of ratepayer money to protect and recover fish in the Columbia River Basin has been inconsistent. Sometimes there has been strong oversight and scientific guidance, and at other times little oversight or scientific guidance. While this situation has improved in recent years, too often money has been used to fund bureaucracies and process as opposed to on-the-ground projects.

We anticipate that as the region's state, federal and tribal agencies improve their collaboration and focus on meeting the obligations of the Endangered Species Act, Clean Water Act, Northwest Power Act and tribal rights under treaties and executive orders, it is likely that the cost of the effort will increase. As a result, we expect decision-makers to redouble their efforts to ensure that funding decisions are informed by independent scientific review, all funding is used in an efficient and accountable manner, and funding is prioritized for actions that most directly advance the goal of protecting and restoring salmonids and other aquatic species to sustainable and harvestable levels.

RECOMMENDATIONS

Funding

Fish and wildlife programs should be streamlined, and rules should be more flexible and goal-oriented. We endorse BPA's stated commitment to increase the amount of ratepayer dollars to support salmon recovery. Congress should similarly increase the amount of federal appropriations, in recognition of the fact that fish and wildlife of the Columbia River Basin are national resources and their protection satisfies obligations in federal law, including treaties with Indian tribes and Canada, the Endangered Species Act, the Clean Water Act and the Northwest Power Act.

Federal financial assistance, both from Congress and/or BPA, should be provided to help fund existing activities designed to improve ecosystem health and fish and wildlife health and protection. These include state and tribal on-reservation programs to develop total maximum daily loads (TMDLs), enhance water quality monitoring, secure water and land rights for fish and wildlife benefits, implement the Lower Columbia River Estuary Program, undertake other watershed restoration activities and, where necessary, establish instream flows.

Accountability

We believe the principles and activities in this document will protect the Federal Columbia River Power System and also recover and rebuild Columbia River Basin fish and wildlife. There will be a significant cost, but we expect the power system to pay only its fair share. Having said that, nothing jeopardizes the recovery effort, and the benefits we receive from the Federal Columbia River Power System, more than the perception and the reality of ratepayer funds being misspent. The region needs a strong program to ensure a far better accounting of the spending than we have received to date.

The Council should continue to work to ensure the accountability of each project it recommends to Bonneville for funding -- accountability in terms of meeting program goals and accountability for the expenditure of ratepayer money.

Accountability for meeting goals:

All projects recommended by the Council should have explicit quantitative goals, and the projects should be rigorously evaluated for their ability to meet these goals.

Accountability for expenditures:

Expenditures by Bonneville, the Council, the Columbia Basin Fish and Wildlife Authority, state agencies and project sponsors may make sense individually, but not when considered in total. Planning and overhead expenses must be kept to a minimum, and project expenditures should focus on activities that benefit fish and wildlife.

Specifically, we recommend that the Council:

- <u>Prepare an Annual Accountability Report:</u>

To better understand Bonneville's expenditures in a basinwide context, and to improve accountability to the ratepaying public, the Council should prepare an annual report to clearly document progress toward meeting fish and wildlife mitigation goals, and how ratepayer money is being spent. A specific breakout should be provided on funding for ESA-listed species.

The report could provide assurance that Bonneville's expenditures are directed toward on-the-ground projects rather than redundant or excessive planning processes and that funding for research is clearly focused and prioritized. By addressing project failures as well as successes, the report could show progress -- or lack of it -- toward goals and demonstrate that projects are being effectively monitored and evaluated.

- <u>Consider Shifting Contract Management:</u>

The Council and Bonneville should study the possibility of transferring project contracting responsibility from Bonneville to a neutral entity.

In its unique regional role, the success of Bonneville depends on maintaining good relations among a wide range of parties, including many of the parties with which it contracts for fish and wildlife project implementation. This need for good relationships creates a potential conflict with the regional interest in accountable and businesslike implementation of fish and wildlife projects, and the enforcement of contractual terms. Simply put, there would be an inherent efficiency in having a neutral entity responsible for project contracting.

Transferring contracting authority to a neutral entity also would avoid complicated, time-consuming federal contracting procedures.

This proposal should not be seen as a criticism of Bonneville's fish and wildlife staff but as a shift of responsibility that would benefit both Bonneville and the fish and wildlife program by increasing the efficiency of program management, reducing the potential for conflicts of interest and improving public accountability for the expenditure of ratepayer dollars. If the shift occurs, a more independent oversight of contract management should be structured in a way that allows Bonneville to ensure its contracts are properly and efficiently carried out.

- Establish a Coordinated Information System

Also under an improved accountability initiative, but singled out for special attention, is the need to establish a coordinated information system. Although the Pacific Northwest is data rich, it is information poor. Data is stored in a random and haphazard fashion in some cases, in highly organized and computerized fashions in other places, and in combinations of these approaches in still other cases. The region needs a standardized information system that is capable of providing answers to basic questions regarding the documentation of progress toward recovery of salmon and other aquatic species. This information needs to be provided in a form accessible to everyone as part of the annual accountability report. Creating such a system is a task for the Council; we ask that it be done by October 1, 2001.

VIII. THE CHALLENGE AHEAD

The Columbia River Basin is a great natural resource and a dynamic economic engine and, for both these reasons, is critical to the well-being of the four states in the region. The Columbia River Basin's hydropower system is part of our legacy in the Northwest, built through the foresight of our leaders and the skill and determination of our workers, on our waterways and across our landscapes.

But we also recognize the impact the hydropower system has had on our fish and wildlife populations, particularly anadromous fish. We have benefited in an economic sense, but we have lost a healthy ecosystem. We wish to restore that healthy ecosystem as part of the Northwest legacy we leave to our children and their children.

This is a challenge of course, and one we accept. It is the federal government's role to administer the Endangered Species Act and to uphold tribal trust responsibilities. But the states also have an important role and responsibilities, as do other regional entities. Agreement on a regional approach, consisting of specific federal, state and regional plans that protect both our salmon and our communities, should be reached and accepted by federal and state officials in consultation with tribal leaders no later than January 1, 2001. Reaching such agreement, as well as implementing the other recommendations in this document, will enable all of us, together, to begin to fulfill our respective roles and responsibilities and meet the challenge that lies ahead.

EXHIBIT B – TESTIMONY OF GOVERNOR KEMPTHORNE, SEPTEMBER 13, 2000

IDAHO'S PERSPECTIVE AND REGIONAL CONTRIBUTION TO RECOVERY OF COLUMBIA BASIN ANADROMOUS FISH

DIRK KEMPTHORNE, GOVERNOR

Testimony of Governor Dirk Kempthorne

Before the
Subcommittee on Fisheries, Wildlife, and Water
United States Senate

September 13, 2000
Washington, D.C.

Mr. Chairman and distinguished members of the Subcommittee, I appreciate the opportunity to appear before you today and articulate my perspective on one of the most complex issues of the day - salmon recovery in the Pacific Northwest.

Introduction

One week ago today, I was at Redfish Lake 900 river miles inland from the Pacific Ocean near Stanley, Idaho, just over the summit from Sun Valley. The name originated from the color of the beautiful salmon returning to spawn in their birthing waters. I was joined by the Idaho Dept. of Fish and Game, legislators, and school children from Filer and Stanley to observe and assist the 36 (26 natural 10 hatchery) marvelous salmon finish their return from the ocean. These wild and hatchery salmon had returned to spawn and start the cycle anew.

It is Idaho's intent and it is my intent and the intent of those school children to perpetuate this stock and all stocks of Idaho's fabulous salmon. Our commitment is unquestionable. The questionable part is whether the federal agencies are to help or to hinder our efforts. Conflicting federal laws and past haphazard coordination have substantially contributed to the decline of our salmon.

I. Idaho's Perspective on the Problem

Prior to the time I took office in January of 1999, my Administration began preparing for the upcoming decisions that have now been released for public review and comment by the federal agencies. And we have been preparing for a very compelling reason: we stand to lose nothing short of everything in the aftermath of the salmon recovery debate and, perhaps, ironically, with no recovery of the salmon.

Let me give you Idaho's common perspective on this issue as perhaps articulated by some of our stakeholders in this process.

The federal agencies charged with recovering the anadromous fish believe that they need Idaho water to help flush the fish out to the ocean. Some groups argue that the four Snake River dams, which support important transportation and agriculture components in Idaho, should be destroyed.

Meanwhile, some of the fish that leave Idaho in the spring are being eaten alive by birds in the estuary before they even have a chance to migrate to sea. Once out in the ocean, they might be harvested.

Several years later, if they are lucky, they will return and could be eaten by predators at the mouth of the estuary or, further up the river, subject to tribal harvest.

My point of all this is not to point the finger at any single component of this problem, but instead describe how from Idaho's perspective, sacrificing our state's water and voluntarily improving our native habitat may seem like a futile exercise when it is such a Herculean effort to get anadromous fish out and back to our state. Our state is ground zero in the recovery of these important species.

II. The Four Governor's Agreement

I would like to briefly describe what we see as our role in recovering the species and how we have contributed to this process.

I have long believed that only through a regional collaborative effort will there ever be a real chance for recovery of anadromous fish in the Pacific Northwest. In July of this year, I was pleased to join the other governors in the region in an unprecedented agreement on the essential principles for recovery and recommendations to implement these recommendations.

The agreement recognizes that every state in the region and all of the stakeholders impacted by this process must step forward and contribute. No one state can recover salmon alone, just as no single state can afford to shoulder a disproportionate burden of the process. Only through regional cooperation - not dictates by the federal government – is there a chance to achieve real success.

The Four Governors strategy involves several key elements important to Idaho.

First, the federal agencies should document the benefits of flow augmentation and the precise attributes of flow that may make it beneficial.

Second, harvest impacts must be reduced on listed, wild fish in the ocean and Columbia River. Idaho has been blessed with a great return of salmon this year, in fact the most in nearly a quarter century. Most were hatchery fish and therefore not counted toward Endangered Species Act listed salmon or for salmon recovery. We can get hatchery fish through the gauntlet of downsteam impacts but we don't get the same with wild salmon. Why? Because our brood stock is limited in numbers and we are breeding the smallest of the salmon because the fishery nets only allow the smaller fish to escape upriver to spawn.

Third, the region must implement actions now that can and should be done without breaching the four lower Snake River dams.

Finally, predation of all kinds, including terns and marine mammals, must be limited.

I want to publicly express my appreciation to Governor Kitzhaber, Governor Racicot, and Governor Locke for their diligence and cooperation in achieving this historical milestone. And the gentlemen here today to speak on their behalf, Eric Bloch, John Etchart and Larry Cassidy, also played key roles along with Dr. Tom Karier and Bob Nichols from the State of Washington. I also want to acknowledge the work of Jim Yost and Michael Bogert of my staff.

I have enclosed a copy of the Four Governors Recommendation for the Subcommittee members.

III. Idaho's Perspective and Contribution to Salmon Recovery

What can be done now and in the near-term to help the fish?

I believe that any effective program to recover the species must be supported by science, politically palatable, and economically feasible. My perspective on this problem is slightly different from the traditional “All-H” approach – Habitat, Harvest, Hatcheries, and Hydropower. I start by adding one more H – Humans.

A. Humans

From my vantage point, much of Idaho’s culture and economy are at stake in the Biological Opinion and the All-H documents to be discussed in this subcommittee today

No singular component of the salmon recovery burden should be borne on the backs of any single stakeholder to the process, including the states. Let me give you the most recent example of this problem.

The United States Army Corps of Engineers recently estimated that over 640,000 listed salmon and tens of millions of hatchery stock are eaten alive at the mouth of the Columbia River estuary during the spring migration season. The culprits: the world's largest colony of voracious fish-eating Caspian terns who just happen to be nesting on federally-created Rice Island at the time the young salmon and steelhead are attempting to make their way to sea.

Idaho participated in a collaborative process involving the states and federal agencies, including the Corps and the United States Fish and Wildlife Service. This process resulted in a plan that involved providing alternative nesting habitat for these birds, which happen to be protected under the Migratory Bird Treaty Act. The plan that was developed included a component that included harassing these birds from the most critical of areas where the endangered fish are slaughtered by the birds.

Not surprisingly, a group of environmentalists brought a lawsuit and claimed that the Corps had failed to comply with the National Environmental Policy Act and asked that the harassment strategy be halted immediately.

Their key piece of evidence? Written comments by the Fish and Wildlife Service that science had yet to prove that saving 15-25 million smolts, of which 640,000 are ESA listed smolts, had any proven benefit to salmon recovery. A federal judge bought the argument and endangered fish are now being consumed by non-endangered birds with the willing assistance of the Fish and Wildlife Service.

I submit that as a matter of fundamental science, a protected young salmon that is eaten alive by a bird is not going to come back to Idaho to spawn.

However, my prospective is a bit more focused. At the same time that Fish and Wildlife is telling us that saving 640,000 listed fish will do nothing to recover these endangered species, the federal government is assessing how much Idaho water is needed to seemingly make fish migration easier. The answer to this question goes to the very life blood of Idaho's agricultural economy in the Upper Snake River Basin.

How can the federal government tell Idaho and the world that preventing the slaughter of hundreds of thousands of endangered young salmon in the Columbia River estuary will have no impact on the problem, and then tell us that more water from our state is needed to get the fish out to sea?

Several weeks ago, I received a report that during the height of both the summer migration and irrigation seasons in the Lemhi Basin, there didn't seem to be enough water to go around. I sent my staff over to talk to the irrigators and see what could be done to accommodate both their rights to irrigation water and the needs of the fish.

Their message? Governor, you tell us when the fish need the water and we will make it available. They also told us that no one knows or cares about these salmon more than those who have been living in that basin all of their lives.

The aftermath of this has been a renewed spirit of cooperation between the locals, the state, and the federal government. Our discussions to resolve this problem represent a model of inter-governmental relationships, and I am optimistic that we will achieve success.

But I remain firm that the only way we will see results in the region is if state law is respected and the locals are brought into the process from the beginning.

I use this example to highlight the contributions from all of the stakeholders that must occur in order for there to be any chance of progress in salmon recovery. With this, I will quickly move on to our perspective on the other H's.

B. Habitat

My perspective on habitat improvement is that the Endangered Species Act, as currently implemented, provides no safe harbors if private landowners voluntarily improve conditions for salmon. Through Idaho's own initiative, Idaho stakeholders have joined together to conserve important habitat. One example is Burgdorf Meadows, where over 51% of critical spawning for summer chinook has been preserved. Burgdorf Meadows is a classic example of Idaho stakeholders working together to achieve a common goal.

Stakeholders would voluntarily undertake habitat improvements if there were some safeguards in place so that after those improvements were implemented, the federal agencies or private law suits would not try to take a second bite of the apple or demand that they make additional improvements. After assuming a voluntary load, this final straw may break the back of even an economically viable camel.

But I also understand that we can make important additional habitat improvement in Idaho. I am committed to identifying things we can do immediately, such as diversion screening and water quality improvement, in order to make things better for fish in Idaho.

On the other hand, as we move forward on these things, we expect that the region will look seriously at predator control and improvement in the estuary conditions.

Recent studies and salmon returns suggest that ocean habitat is a significant factor influencing salmon survival. NMFS should work with the region to conduct an intensive study to address the role of the ocean in fish recovery, including the relative impact fish of mortality due to ocean predation, lack of food sources, temperature problems and harvest regimes.

C. Harvest

Idaho continues to be perplexed that wild fish, listed under the Endangered Species Act, can be subjected to a regulated harvest at all. Can you imagine the hue and cry if the government suddenly declared a "harvest" season on the grizzly bear?

I am sensitive to the industries in the Pacific Northwest that depend on a yearly salmon harvest, and I am similarly mindful of the harvest rights possessed by Native American tribes through treaties with our federal government.

Idaho, as with other states in the region, is committed to the process of discussing harvest allotment through the *United States v. Oregon* litigation. This is one area where collaboration by all of the region is ongoing and should continue.

D. Hatcheries

The hatchery arena has a symbiotic relationship with harvest allocation, and Idaho generally supports scientifically based hatchery programs.

In the case of captive brood stock hatcheries, this remains a program of vital importance to Idaho. This is the program at Redfish Lake I referred to earlier.

As a means of supplementation, the hatcheries in Idaho provide our sportsmen an opportunity for a fishing season, and are an excellent management tool while we rebuild our wild stocks.

Hatchery operations must be improved to provide salmon for harvest "conservation (mitigation) hatcheries" as required in the Lower Snake River Fish and Wildlife Compensation Plan established when the four dams were constructed to mitigate for the losses caused by the dams. This was done when the estimated mortality at the dams was about 47%. We have now reduced that mortality to about 25%, yet we continue to maintain or increase the number of smolts for mitigation.

We also have supplementation hatcheries that provide additional salmon stocks to those streams with wild or natural stocks so that the numbers can be increased. The question is which of those wild stock areas should be maintained as wild, native, or natural salmon refuges without the interference of the supplementation stocks.

The mitigation stocks are of a high enough number that their harvest is causing an impact on wild natural stocks (the listed species). All these fish may return from the ocean to the Columbia River at about the same time, and it is difficult to only harvest the mitigation hatchery stocks and not harvest some of the wild stocks. This incidental take of wild stock when we try to harvest mitigation stocks is currently excessive.

Some ways it can be reduced is by using a different method of harvest (from nets to lines or fish wheels) or selective fisheries, which is fishing only when the mitigation hatchery fish are present or to use terminal fisheries (fishing for the mitigation stocks after the wild stocks have gone up a tributary to their spawning area). We have successfully used larger scale nets that have allowed the smaller stocks to continue to migrate while the larger fish are caught. The impact to Idaho is that for years our brood stocks were the smaller fish and not the biggest healthiest brood stocks.

E. Hydropower

From my perspective, the debate over dam breaching will continue as long as reasonable scientists differ over the data. One fact that is not disputed is that breaching the four lower Snake River dams would have no benefit to the vast majority of our endangered salmon. Eight to twelve listed species would not be affected by breaching, as they reside downstream of these dams. And even if the science was clear today – and it is not - it would take at least a decade of political debate right here in Washington before they are removed.

The costs of dam removal could be as high as $1 billion, and, by the Corps' own calculation, it could be several years before the silt and debris left behind the dams becomes manageable enough to provide any benefit to the fish. I am left with the unsettling impression that with such political and scientific controversy ahead in the next 20-25 years, the game could be lost before it has even started.

Accordingly, until I have clear evidence that the salmon can expect immediate improvement if the dams are removed, Idaho is opposed to taking on the risks to our Port of Lewiston and Idaho agricultural economy.

But this perspective does not end the "to do" list for the dams. During my tenure as your colleague in the United States Senate, I was committed to investing in dam improvements while the science continues to be debated.

The best and brightest minds in the federal government and the states should be dedicated to making fish passage at the dams better so that the fish receive the benefits of the finest technology our nation has to offer.

I support minimum gap runner turbine technology in order to improve the reasonable accommodation that must be made for the regions' hydropower needs and the salmon migration. This technology is being installed at Bonneville Dam and the preliminary results have indicated increased fish survivability.

Likewise, fish guidance curtain (screen), turbine intake screens, fish collectors, adult fish ladders, juvenile fish bypass systems, and spillway defectors have suffered from technological neglect and installation while the controversy over the existence of the dams has raged onward. This must end immediately, because the losers in the failure to make capital improvements in these structures are the salmon.

Finally, at the risk of sounding repetitive, I must put on the record my position about augmented Snake River flows as a benefit to out-migrating juvenile salmon. At my direction, the Idaho Department of Water Resources has studied the issue extensively in cooperation with the Idaho Department of Fish and Game. They have determined that based on the current flow-survival data developed by NMFS, there is no basis for NMFS concluding that early or late summer flows from the Upper Snake provide significant biological benefits for out-migrating juvenile salmon.

There is not enough water in the Snake River Basin to meet the Biological Opinion flow objectives. These flow objectives are essentially arbitrary thresholds. The NMFS has for too long been absorbed with securing a few extra acre feet from this or that reservoir without apparently ever stopping to question whether the unending struggle over flow augmentation is really delivering salmon recovery.

For instance, when NMFS briefed the states last spring regarding the "Herculean" measures contained in the new Biological Opinion, the very first measure mentioned was additional flow from the Snake River Basin. While the *effort* to secure this additional water may indeed be Herculean, the resulting *benefit* to the fish is microscopic even under the most optimistic assessment of the flow/survival relationship.

There is an understanding – often acknowledged in private but seldom spoken in public – that the upper Snake River Flow augmentation measures are really an effort to secure political balance rather that meaningful benefits to the fish. The notion is that "everyone must hurt" in order for a regional plan to be politically viable. Some of the more aggressive, or perhaps cynical, participants in the salmon recovery debate go further to suggest that draconian levels of flow augmentation should be extracted as a kind of punishment for failure to adopt dam breaching. Their thinking is that if the pain associated with "aggressive" non-breach measures can be ratcheted up high enough, then perhaps the region will opt to take out the four dams on the lower Snake River.

Regardless of whether NMFS subscribes to either of these views, we have the distressing sense that NMFS' campaign for more upper Snake River flow augmentation represents a grand political gesture rather than a clear-eyed examination of the biological benefits, the economic costs, and environmental impacts of what is being proposed.

Idaho's complaints about the lack of disciplined analysis of flow augmentation have sometimes been met with the response that "every little bit helps." This aphorism is no substitute for the critical thinking required for a true salmon recovery plan. The fact is that the Federal Caucus is not doing "every little bit" it can – nor should it if the resulting gains for the fish are meager and the impacts are massive. The record is replete with instances in which the federal government has chosen not to do more for the listed species based on non-biological factors.

For instance, NMFS actually permitted the harvest rate on Snake River spring chinook to increase this year relative to recent years because of the large number of hatchery fish returning to the river. This increase was justified on the basis that additional harvest amounted only to a few percent of the overall run. But, this does not square with the "every little bit helps" principle that underlies upper Snake River flow augmentation efforts, which deliver even smaller increments of survival. Moreover, NMFS' biological opinions allow cumulative harvest rates on Snake River fall chinook in ocean and in-river fisheries to remain at close to 50%. And, tern population numbers in the Columbia River estuary continue to climb – with significant impact to the entire Columbia salmon and steelhead run. Yet, NMFS still has not taken decisive action to move these predators from the estuary.

Nonetheless, our State Legislature enacted and I signed a one-year authorization for the Bureau of Reclamation to access 427,000 acre-feet of Idaho water for flow augmentation purposes. This good-faith gesture should be recognized as my willingness to continue to participate in a regional solution.

IV. Conclusion

I appreciate the opportunity to present my perspective on these important issues today, and I look forward to the challenging work ahead for all of us in the region.

Idaho is optimistic that the state and regional stakeholders will join together and empower themselves throughout this process. However, Idaho remains concerned that the All-H Paper has failed to give deference to the objectives outlined in the Four Governor's Recommendations. At the end of the day, the best solutions are those that are owned by the participants rather than those that are imposed by federal edict.

Thank you.

EXHIBIT C – FISH AND WILDLIFE ACTIVITY MAP

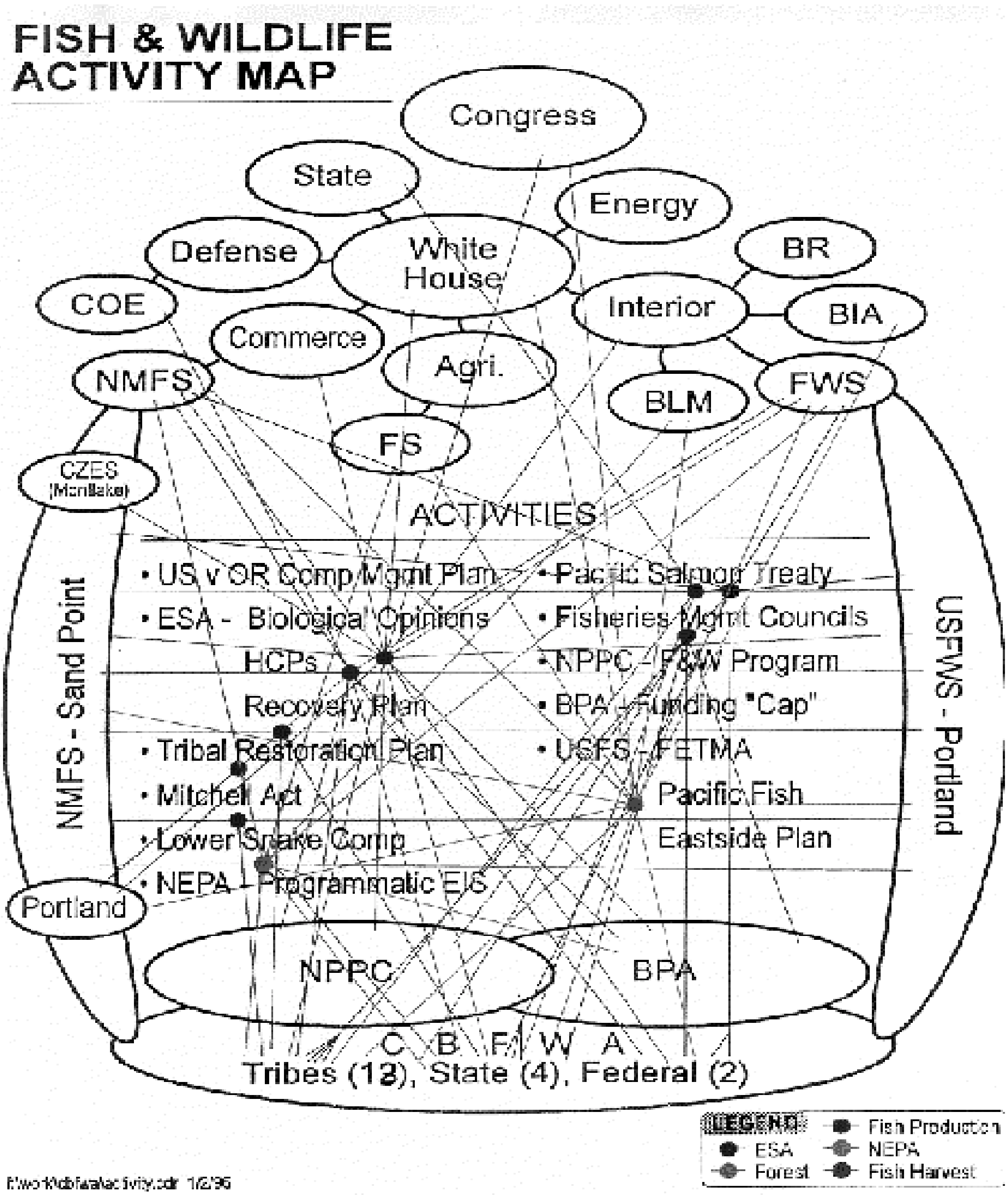

EXHIBIT D1 - IDAHO'S FEDERAL AND STATE LAND MANAGEMENT

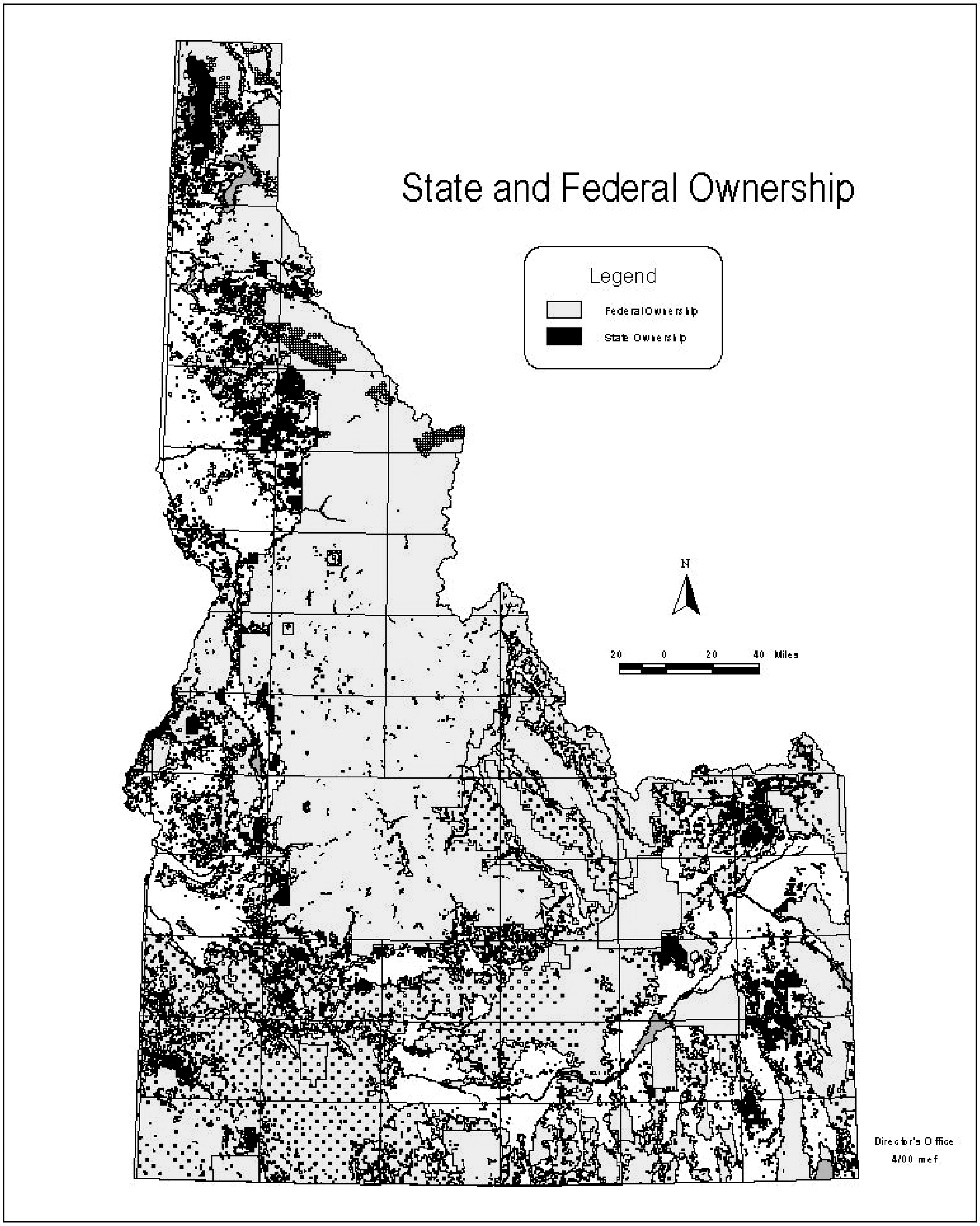

EXHIBIT D2 - IDAHO'S FEDERAL AND STATE LAND MANAGEMENT

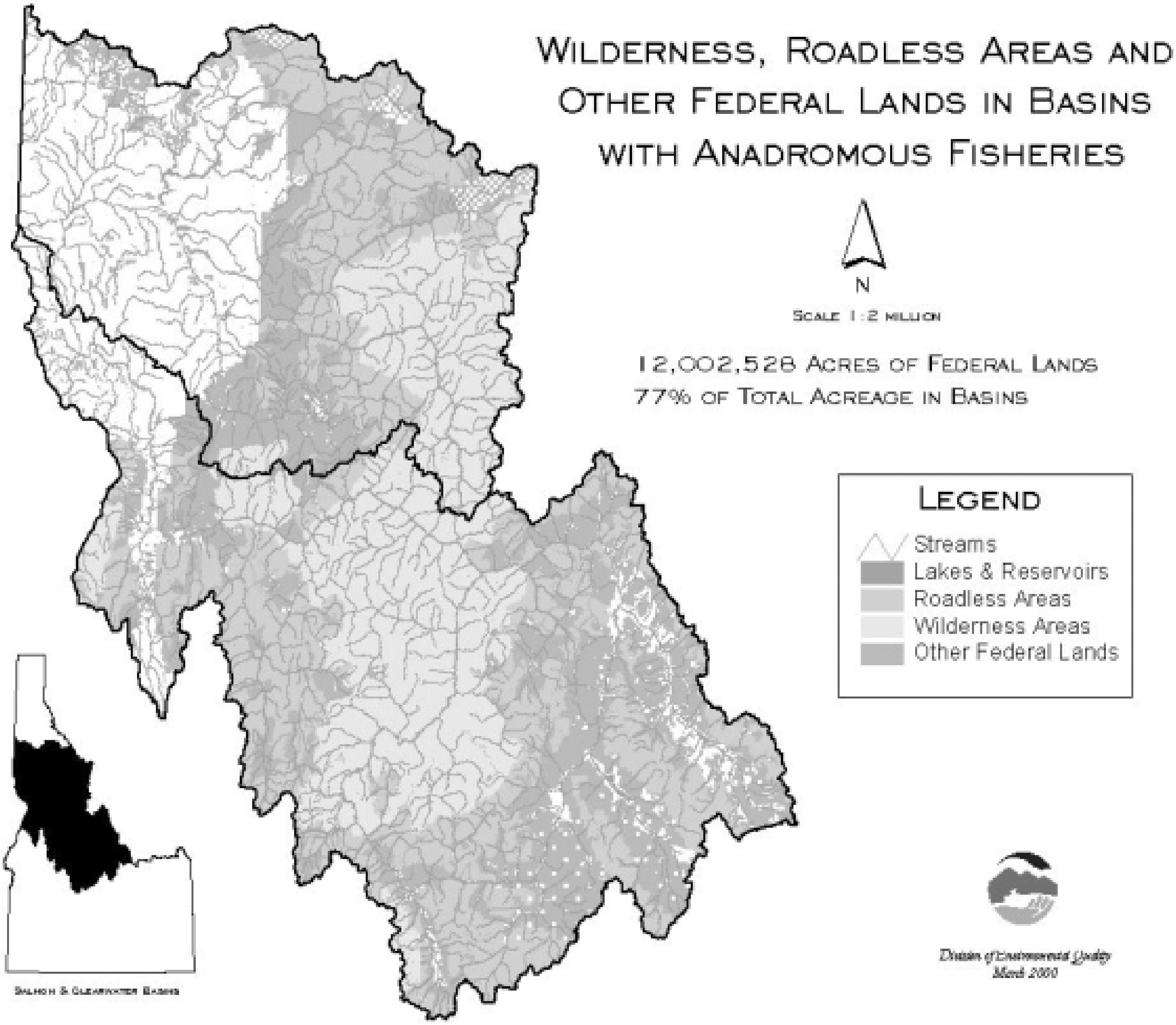

EXHIBIT E – IDAHO'S PROTECTED RIVERS AND STREAMS

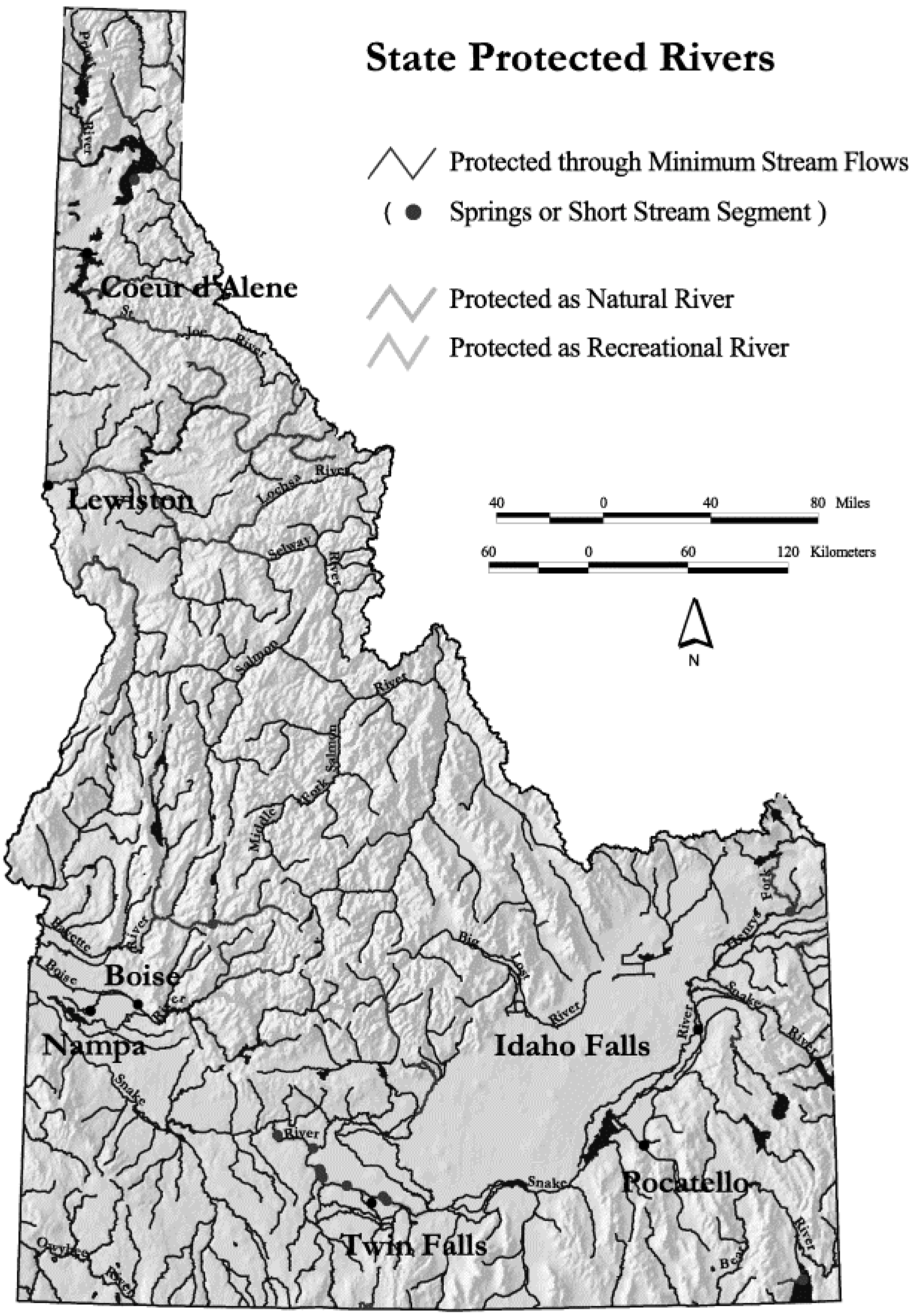

EXHIBIT F - BPA FUNDED ESA PROJECTS IN IDAHO

BASIN	PROJECT #	PROJECT
CLEARWATER	198200100	INVENTORY OF NEZ PERCE RESERVATION STREAMS
CLEARWATER	198350100	RED RIVER FISH HABITAT IMPROVEMENT
CLEARWATER	198350200	CROOKED RIVER PASSAGE
CLEARWATER	198352200	LOLO, CROOKED FORK & WHITE SANDS CR HABITAT WORK
CLEARWATER	198400500	RED & CROOKED RIVERS HABITAT/ PASSAGE IMPROVEMENTS
CLEARWATER	198400600	LOLO, CROOKED FORK & EL DORADO CREEKS HABITAT WORK
CLEARWATER	198403100	CLEARWATER BASIN HABITAT IMPROVEMENT STUDY
CLEARWATER	198709900	DWORSHAK RESIDENT FISH STUDY / IDFG
CLEARWATER	198711100	DWORSHAK WILDLIFE MITIGATION AND ENHANCEMENT PLAN
CLEARWATER	198711200	OROFINO CREEK PASSAGE STUDY
CLEARWATER	198740600	DWORSHAK WILDLIFE MITIGATION AND ENHANCEMENT PLAN
CLEARWATER	198740700	NEZ PERCE DWORSHAK MODEL FOR RAINBOW TROUT & BASS
CLEARWATER	198801500	LOWER CLEARWATER HABITAT STUDY
CLEARWATER	198815400	DWORSHAK WILDLIFE MITIGATION & ENHANCEMENT
CLEARWATER	199005100	LOWER CLEARWATER AQUATIC MAMMAL STUDY
CLEARWATER	199009100	PURCHASE DWORSHAK OLD GROWTH
CLEARWATER	199205700	DWORSHAK WILDLIFE MITIGATION TRUST
CLEARWATER	199206900	CRAIG MOUNTAIN (DWORSHAK WILDLIFE) MANAGEMENT
CLEARWATER	199303500	LITTLE PONDEROSA RANCH PURCHASE, RED RIVER MEADOW
CLEARWATER	199303501	RED RIVER RESTORATION (LITTLE PONDEROSA RANCH)
CLEARWATER	199303600	HAYSFORK GLORYHOLE REHABILITATION
CLEARWATER	199406000	DWORSHAK WILDLIFE MITIGATION AGREEMENT MEDIATION
CLEARWATER	199501600	GENETIC INVENTORY - WESTSLOPE CUTTHROAT TROUT
CLEARWATER	199607700	NEZ PERCE NF EARLY ACTION WATERSHED PROJECTS
CLEARWATER	199607701	MEADOW CREEK RESTORATION - USFS
CLEARWATER	199607702	LOLO CREEK WATERSHED
CLEARWATER	199607703	PROTECTING AND RESTORING SQUAW & PAPOOSE CREEKS
CLEARWATER	199607704	LOWER ELDORADO FALLS FISH PASSAGE IMPROVE DESIGN
CLEARWATER	199607705	RESTORE MCCOMMAS MEADOWS
CLEARWATER	199608600	CLEARWATER FOCUS WATERSHED - STATE OF IDAHO
CLEARWATER	199700600	CLEARWATER FOCUS WATERSHED - NEZ PERCE TRIBE
CLEARWATER	199703100	MEADOW CREEK ENHANCEMENT EVALUATION - OSU
CLEARWATER	199703101	MEADOW CREEK ENHANCEMENT EVALUATION - USFS
CLEARWATER	199901400	RESTORE ANADROMOUS FISH HABITAT - LITTLE CANYON CR
CLEARWATER	199901500	RESTORE ANADROMOUS FISH HABITAT - NICHOLS CANYON
CLEARWATER	199901700	REHABILITATE LAPWAI CREEK
CLEARWATER	199901800	QUALIFY/QUANTIFY RESIDUAL STEELHEAD IN CLEARWATER
CLEARWATER	199902800	MEADOW CREEK RESTORATION RESEARCH - UI
SALMON	198335900	BEAR VALLEY, YANKEE & EAST FORKS HABITAT WORK
SALMON	198341500	INCREASE ALTURAS LAKE CR FLOW / BUSTERBACK RANCH
SALMON	198341600	POLE CREEK IRRIGATION DIVERSION SCREENING
SALMON	198402300	CAMAS CREEK RIPARIAN PROTECTION

SALMON	198402400	MARSH, ELK CREEK & UPPER SALMON RIVER HABITAT WORK
SALMON	198402800	LEMHI RIVER REHABILITATION STUDY
SALMON	198402900	PANTHER CREEK HABITAT REHABILITATION STUDY
SALMON	199107100	SNAKE RIVER SOCKEYE HABITAT & LIMNOLOGICAL STUDY
SALMON	199202603	MODEL WATERSHED STUDIES - LEMHI RIVER BASIN
SALMON	199303300	S FK SALMON RIVER ANADROMOUS FISH ENHANCEMENT
SALMON	199306200	UPPER SALMON RIVER ANADROMOUS FISH PASSAGE
SALMON	199401500	IDAHO FISH SCREENING IMPROVEMENT
SALMON	199401700	IDAHO MODEL WATERSHED HABITAT PROJECTS
SALMON	199401701	PAHSIMEROI RIVER - PATTERSON / BIG SPRINGS FLOW
SALMON	199401702	EAST FORK SALMON/ PAHSIMEROI HABITAT (CUSTER CO)
SALMON	199401703	LEMHI HABITAT ENHANCEMENT PROJECT
SALMON	199405000	SALMON RIVER HABITAT ENHANCEMENT AND O&M
SALMON	199600700	UPPER SALMON RIVER DIVERSION CONSOLIDATION PROGRAM
SALMON	199604301	JOHNSON CREEK SCIENTIFIC REVIEW
SALMON	199604303	JOHNSON CREEK WETLANDS DELINEATION
SALMON	199604304	JOHNSON CREEK REAL ESTATE SERVICES
SALMON	199607500	FISH HABITAT IMPROVEMENT - LEMHI SWCD
SALMON	199901900	RESTORE SALMON RIVER - CHALLIS AREA
SALMON	199901901	AQUATIC ECOSYSTEM REVIEW - CHALLIS
SALMON	199902000	ANALYZE PERSISTENCE/DYNAMICS SNAKE R CHINOOK
SALMON	199906900	AQUATIC ECOSYSTEM REVIEW - SALMON RIVER

EXHIBIT G – SALMON SUBBASIN HABITAT IMPROVEMENTS

Fish Habitat Improvements on Private Land 1997 - 1999
Relative to
Waters Listed as Habitat for Salmon and Steelhead
and
Not Fully Supporting Beneficial Uses

Custer and Lemhi Soil & Water Conservation Districts
Soil Conservation Commission
Natural Resources Conservation Service
Salmon Subbasin Model Watershed

HUC	Stream Segment
17060201	Upper Salmon R. - includes:
	East Fork Salmon R.
17060202	Pahsimeroi R.
17060203	Middle Salmon-Panther - includes:
	Freeman Cr., trib. to Carmen Cr.
17060204	Lemhi R. - includes:
	Geertson Cr., Freeman Cr. (trib. To Carmen Cr.)
	Little Sawmill Cr., McDevitt Cr., Wimpey Cr.

Structural Practices Installed 1997 - 1999	Units	Units Treated
Animal Waste System	8	1658 ac.
Channel Vegetation	6	2,600 ft.
Fence	12	153,120 ft.
Fish Habitat Improvement - instream	1	1,200 ft.
Fish Passage Improvement - ladders and weirs	4	
Irrigation System Modification - Reduce barriers, improve instream flows	5	2,950 ac.
Streambank Stabilization Structures	111	64,800 ft.

EXHIBIT H- CLEARWATER SUBBASIN

Fish Habitat Improvements on Private Land 1997 - 1999
Relative to Waters Listed as Habitat for Salmon and Steelhead
and
Not Fully Supporting Beneficial Uses

Idaho Association of Soil Conservation Districts - Division II
Soil Conservation Commission
Natural Resources Conservation Service
Clearwater Subbasin Focus Watershed

HUC	Stream Segment
17060103	Tammany Creek
17060108	N. Fork Palouse River - includes:
	Big Cr., Deep Cr., Flannigan Cr., Hatter Cr.,
	M.Fork Deep Cr., Rock Cr
	S.Fork Palouse River - includes:
	Cow Cr., Paradise Cr., S.Fork Palouse River
17060305	Cottonwood Cr., includes:
	Long Haul Cr., Shebang Cr., Stockney Cr., S.Fork Cottonwood Cr.
17060306	Potlatch River - includes:
	Big Bear Cr., Boulder Cr., Cedar Cr., E.Fork Potlatch R.,
	L. Potlatch, M. Potlatch, Moose Cr., Mud Cr., Pine Cr., Potlatch R.,
	Ruby Cr., W.Fork Potlatch R.
	Big Canyon Cr., L. Canyon Cr., Holes/Long Hollow Cr.
	Lapwai Cr., Mission Cr.
	Catholic Cr., Cottonwood Cr., Hatwai Cr. Jacks Cr., Lindsay Cr.,
	Pine Cr., Rattlesnake Cr., Sweetwater Cr.
	Bedrock Cr., Jim Brown Cr., Jim Ford Cr., Lolo Cr.

Systems Installed/ in Use		**Structural Practices Installed**	
1997 - 1999	**Acres**	**1997 - 1999**	**Units Treated**
Residue Mgmt - Mulch Till	122,846	Fence	150,100 ft
Residue Mgmt - No Till	41,316	Filter Strip	91ac
CRP	58,896	Fish Stream Improvement	30,100 ft
Pasture & Hayland Mgmt.	6,343	Grade Stabilization Str.	59 ea
Pasture & Hayland Plant.	3,604	Grassed Waterway	39,801ft
Prescribed Grazing	1,794	Livestock Water Dev.	5 ea
Wildlife Upland Habitat Mgmt.	7,049	Riparian Forest Buffer	406 ac
		Sediment Basin	88 ea
Total Land Benefited	**241,848**	Terrace	19,730 ft
		Water & Sed. Cont. Basin	171ea

EXHIBIT I – IDAHO'S TMDL SCHEDULE BY HUC

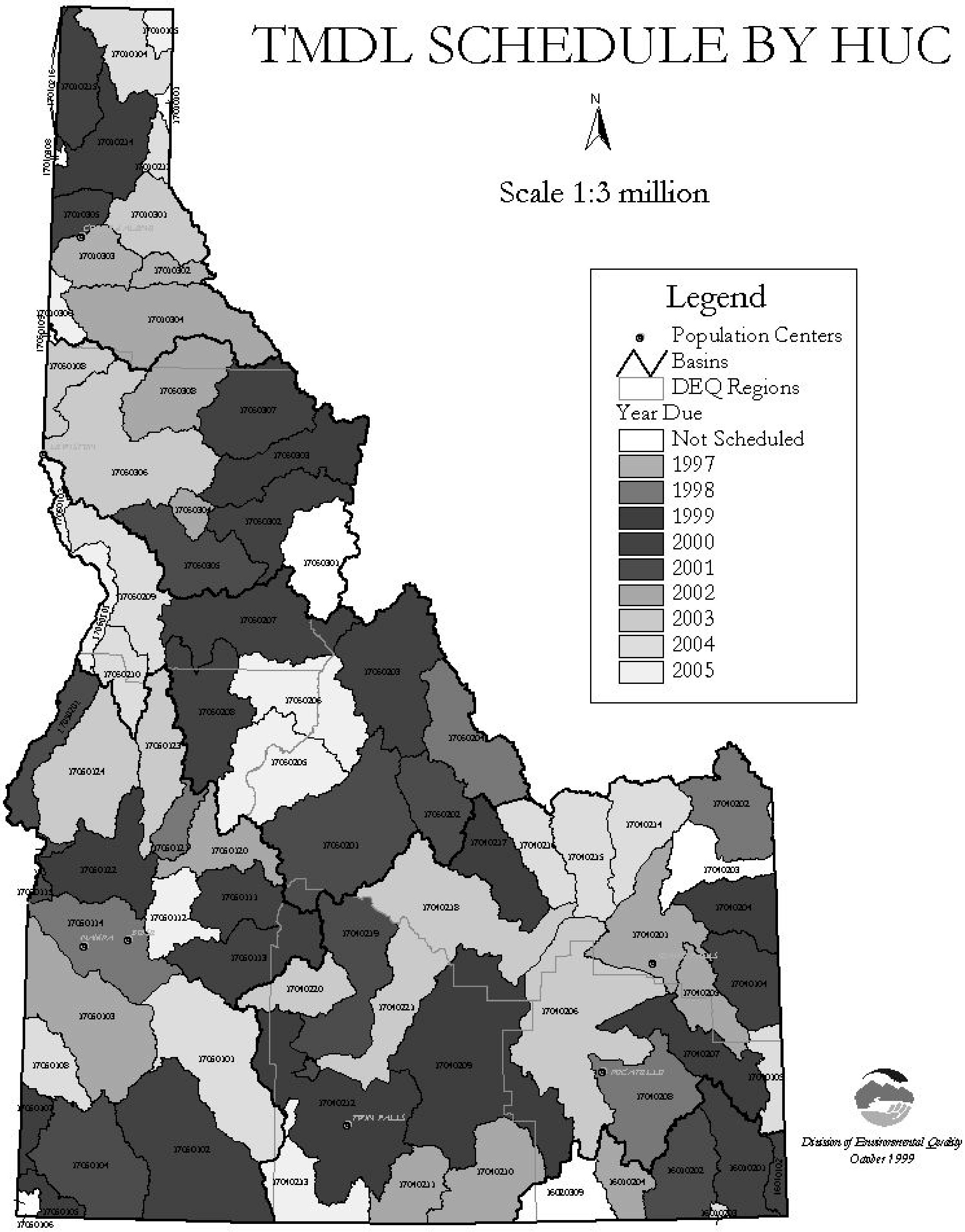

EXHIBIT J – TMDLs IN ANADROMOUS AREAS

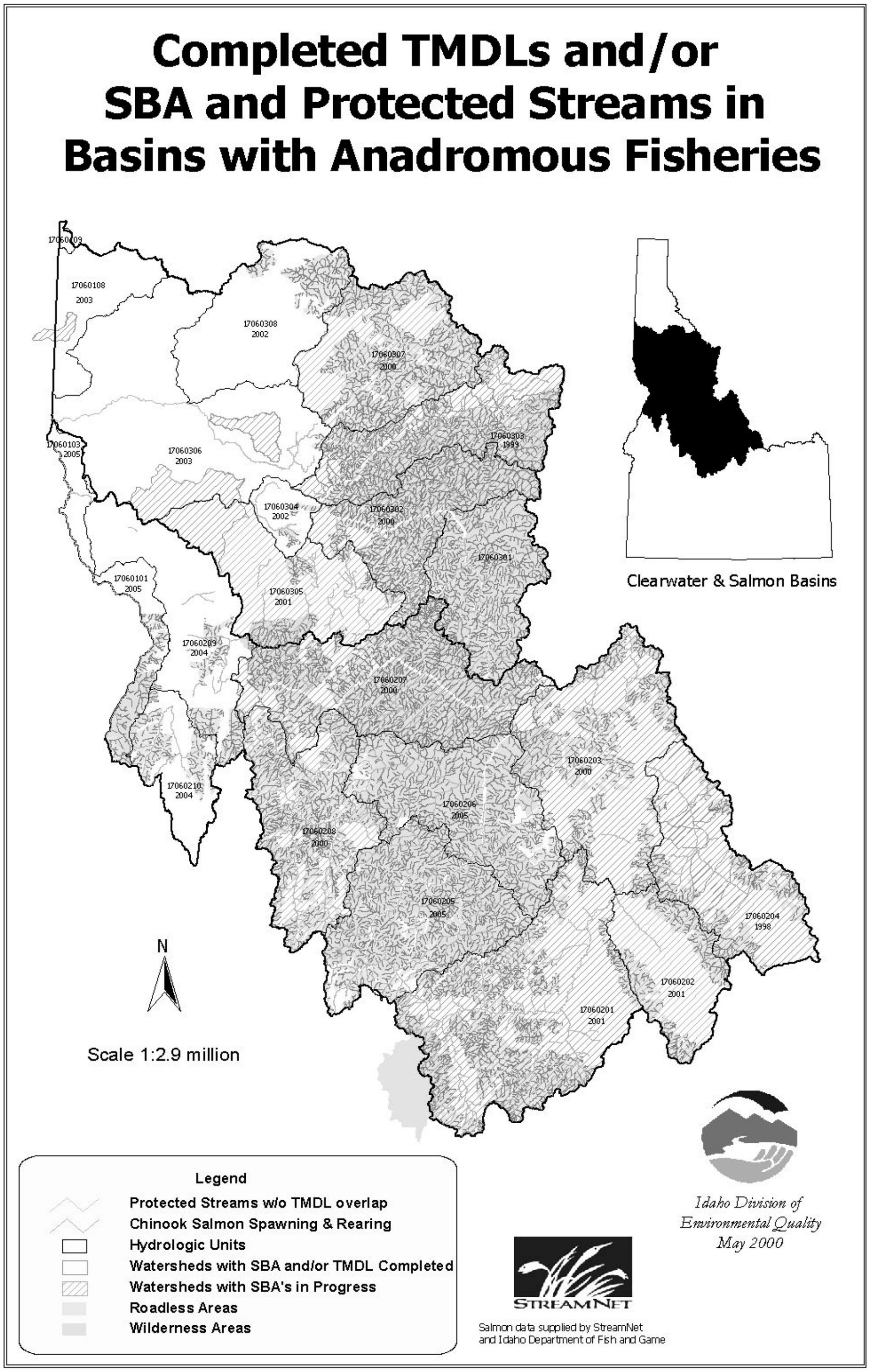

EXHIBIT K – Karl J. Dreher, *et al.*, REVIEW OF SURVIVAL, FLOW, TEMPERATURE, AND MIGRATION DATA FOR HATCHERY-RAISED, SUBYEARLING FALL CHINOOK SALMON ABOVE LOWER GRANITE DAM, 1995-1998 (September, 2000).

Review of Survival, Flow, Temperature, and Migration Data For Hatchery-Raised, Subyearling Fall Chinook Salmon Above Lower Granite Dam, 1995-1998

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The National Marine Fisheries Service (NMFS), the U. S. Fish and Wildlife Service, and the Nez Perce Tribe have investigated migration characteristics of hatchery-raised, subyearling fall chinook salmon (*Oncorhynchus tshawytscha*) in the Snake River Basin from data collected from 1995 through 1998 (Muir et al., 1999). The studies showed that estimated survival from points of release to Lower Granite Dam could be correlated with three environmental variables: flow, water temperature, and turbidity. These correlations are being used in support of flow augmentation in the lower Snake River.

This report provides a review of the data used for comparing subyearling survival to flow rates, water temperature, time of release, and travel time. The principal conclusion of the review is that survival data and flow rates used by Muir et al. (1999), despite showing an apparent correlation between flow rates and survival, do not imply a cause and effect relationship between flow and survival of subyearlings and should not be used as a basis to justify flow augmentation. This is primarily because the experimental design did not address other factors that appear to have strongly influenced migration characteristics and survival.

There is a fourfold basis for this conclusion. First, although flow can be correlated with survival, there is a stronger correlation between estimated survival and release date. The NMFS experimental design assumed that sequential releases of hatchery-raised fall chinook would not influence survival independent of flow, temperature, and turbidity. The high correlation between time of release and survival makes this assumption questionable.

Second, travel times for hatchery-raised, subyearling fall chinook did not correspond with flow rates. For instance, travel times for the early percentile surviving fish (5th, 10th, and 25th percentiles) were **less** at lower flows than at higher flows for most releases. Median travel time for the 5th percentile surviving fish decreased from 33 days to 16 days between the 1st and 6th weekly releases, despite a decrease in the 5th percentile flow indices during the same time from 122 thousand cubic feet per second (kcfs) to 63 kcfs. These travel times and arrival patterns were contrary to what would be expected if the higher flows resulted in significant improvements in survival.

The fact that travel times are inconsistent with flow rates may result from (1) the migration rate being weakly dependent on flow in the flow ranges considered or (2) other important non-flow factors influencing migration rate. An example of a non-flow factor is "readiness to migrate." The NMFS study used hatchery-raised, subyearling fall chinook as surrogates for wild fish. Implicit in the use of these hatchery-raised subyearlings in sequential weekly releases is that the fish are equally "ready to migrate" when released. Longer travel times for portions of early-released subyearlings, and faster travel times for portions of later-released subyearlings, despite substantially decreasing flows, suggests that the fish in the weekly sequential releases may not have been equally "ready to migrate." Differences in states of "readiness to migrate" would confound the analysis of flow and survival relationships. Correlations of flow and temperature with travel time and survival are only meaningful if the groups of fish studied are actively migrating or relatively similar in their state of "readiness to migrate. "

Third, flow rates, velocity, temperature, and turbidity are closely correlated with one another (NMFS, 2000). The current data are insufficient to allow delineation of the effects of individual attributes of flow. Understanding the effects of individual attributes of flow, particularly the usefulness of flow augmentation to compensate for the effects of reservoir impoundment on these attributes, is fundamental to determining the effectiveness of flow augmentation efforts for increasing survival of subyearling fall chinook salmon.

Fourth, additional problems with existing studies must be addressed prior to making conclusions about the efficacy of flow augmentation. These include use of flow and temperature indices that do not represent overall migration conditions; release timing of hatchery-raised fish that is not representative of natural migration; relatively high post-release mortality; and the inability of reach survival estimates to reflect the full spectrum of potential effects from altered water velocities, temperatures, and turbidity during migration (e.g., altered migration timing, bioenergetics, and transition into the estuary and ocean).

In summary, this review does not suggest that flow, or the attributes of flow (water velocity, temperature, and turbidity), are unimportant to migration and survival of subyearling fall chinook salmon. However, existing correlations between survival of hatchery-raised, subyearling fall chinook salmon with flow rates and water temperatures do not support the postulation that augmenting mainstem Snake River flows improves subyearling survival.

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1. INTRODUCTION

The effectiveness of flow augmentation[1] in aiding conservation and recovery of Snake River salmonid populations listed under the Endangered Species Act is questionable. The purpose of flow augmentation has been largely to increase the velocity and/or reduce the temperature of water flowing through mainstem reservoirs in the lower Snake and Columbia Rivers[2]. Although improved adult returns are generally associated with good water years (e.g., high natural flow and spill) during juvenile outmigration, the efficacy of flow augmentation as a substitute for good water years has not been defensibly established.

During the period from 1995 through 1998, the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service, and the Nez Perce Tribe investigated migration characteristics of hatchery-raised, subyearling fall chinook salmon (*Oncorhynchus tshawytscha*) in the Snake River Basin (Muir et al., 1999). Hatchery-raised subyearlings were used as surrogates for wild subyearlings in the survival research. The studies showed that estimated survival from points of release to the tailrace of Lower Granite Dam could be correlated with all three environmental variables examined (flow rate, water temperature, and turbidity). Estimated survival decreased throughout the season, as flow volume and turbidity decreased and water temperature increased (Muir et al., 1999). These correlations have provided the primary basis for the continuation of flow augmentation from reservoirs in the Snake River and Clearwater River Basins (NMFS, 1999).

The purpose of this report is to provide a review of the data considered in the Muir et al. (1999) study within the context of determining the efficacy of flow augmentation for enhancing the survival of subyearling fall chinook. In particular, relationships between flow rates, water temperatures, travel times, and estimated survival of hatchery-raised, subyearling fall chinook salmon between points of release and detections at Lower Granite Dam are examined. This report includes analyses of: (1) flow rates and water temperatures at Lower Granite Dam; (2) estimated survival with 5th percentile flow indices; (3) estimated survival and 5th percentile water temperature indices; (4) estimated survival versus release dates; (5) estimated survival versus release groups; and (6) fall chinook travel times and numbers of detections. Finally, these comparisons are used to draw conclusions about flow rates, travel times, subyearling survival, and the effectiveness of flow augmentation.

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[1] Flow augmentation is defined as the use of water from storage reservoirs, or foregone water storage, to augment natural flows.

[2] For example, mainstem reservoirs in the lower Snake River have reduced average water velocities during the summer migration period to about 1/20 to 1/10 of the velocities that existed prior to construction of the dams forming the mainstem reservoirs (Dreher, 1998).

2. DATA DESCRIPTION

The data used in this review and evaluation consist of: (1) numbers of hatchery-raised, subyearling fall chinook salmon released from four sites along the Snake and Clearwater Rivers; (2) estimated subyearling survival rates from point of release to Lower Granite Dam[3] on the lower Snake River; (3) travel times of the surviving fish between point of release and Lower Granite Dam based on the date of release and date of detection; and (4) flow and temperature data from the lower Snake River at Lower Granite Dam. The data were collected as part of a study by NMFS, the U. S. Fish and Wildlife Service, and the Nez Perce Tribe (Muir et al., 1999) investigating migrational characteristics of hatchery-raised, subyearling fall chinook salmon as substitutes for wild subyearlings (Muir et al., 1999).

Hatchery-raised, subyearling fall chinook salmon were released at four locations into the Snake and Clearwater Rivers upstream of Lower Granite Dam from 1995 through 1998 to estimate survival in these reaches. Details about release methods were provided in Hockersmith et al. (1999). The release points on the Snake River were (1) Pittsburg Landing; (2) Asotin; and (3) Billy Creek. Subyearlings also were released into Big Canyon Creek (referred to as the "Clearwater" site), which flows into the Clearwater River near Peck (Figure 2-1). In addition, several large releases were made at Pittsburg Landing (PD) for tracking migration downstream of Lower Granite Dam. The released fish were all raised under similar conditions at the same time in the Lyons Ferry hatchery in the state of Washington. The subyearlings were released at approximate one-week intervals between early June and mid-July (Table 2-1). Most releases contained between 1,119 and 1,353 fish, although the PD releases contained about 7,000 fish. A passive integrated transponder (PIT tag) was inserted into each fish prior to release, allowing monitoring of its downstream progress and survival. The PIT-tagged fish were counted as they passed detectors in the fish bypass system at Lower Granite Dam. The release numbers and survival data are provided in Appendix A. Flow and temperature data also are available at www.cqs.washington.edu/dart/dart.html.

The apparent relationships between estimated subyearling survival to Lower Granite Dam, flow rate, and temperature in the lower Snake River (e.g., NMFS, 1999; Muir et al., 1999) are constructed using flow and temperature "indices." The flow and temperature indices consist of the average daily flow and temperature values, respectively, at Lower Granite Dam averaged over the interval between the release date and the date that a given percentile (e.g., 5^{th}, 10^{th}, 25^{th}, 50^{th}, 75^{th}, or 90^{th} percentile) of the surviving fish is detected at the dam. For example, the 5^{th} percentile flow index corresponding to a release of 1,000 fish from which 500 survive would be the average flow rate between the release date and

[3] Survival estimates developed by NMFS were provided by Steve Smith of NMFS on November 18, 1999, and are included in Appendix A.

the date that the 5th percentile of the surviving fish (i.e., the 25th fish) is detected at Lower Granite Dam. The number of days used to calculate the flow and temperature indices varies by release depending on the travel time for each release.

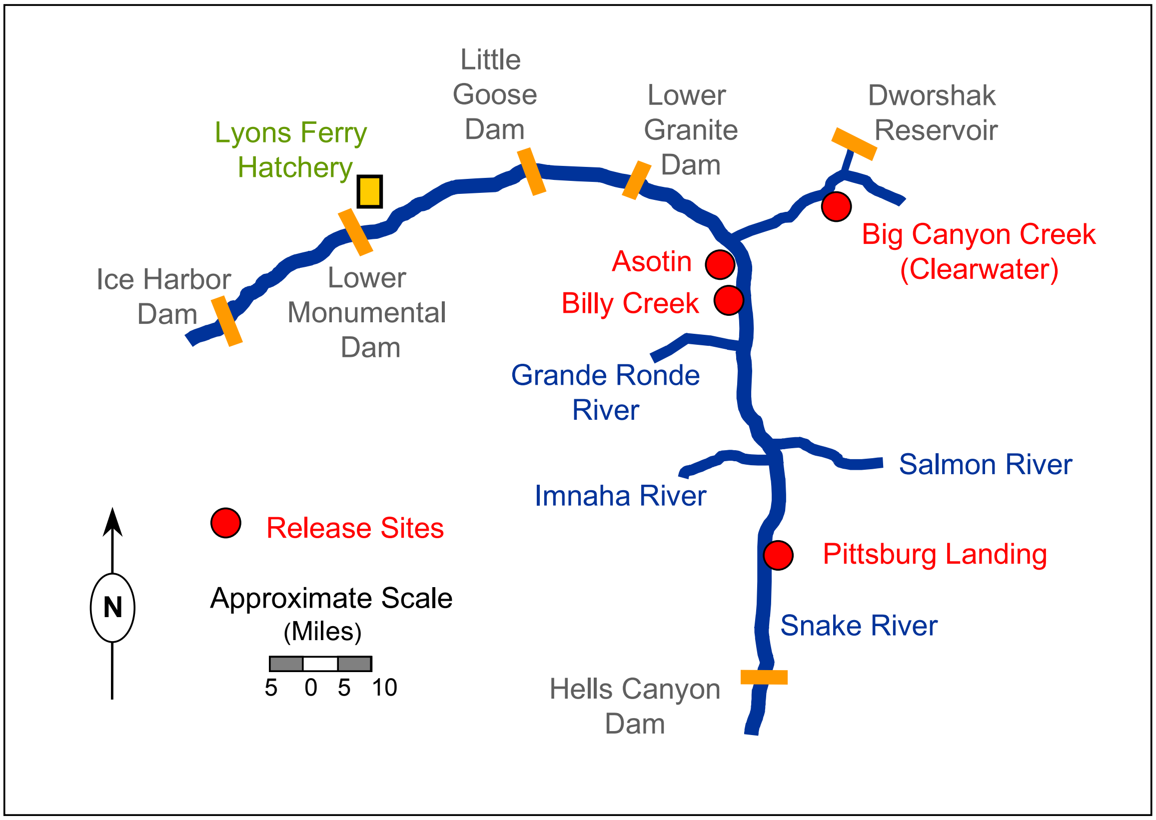

Figure 2-1: Map of release sites for hatchery-raised, subyearling fall chinook salmon (adapted from Muir et al., 1999).

The arrival dates for each percentile of surviving fish are determined by counting the arriving salmon as they are detected at the Lower Granite Dam fish bypass system. The travel time (in days) for each percentile of surviving fish is determined by using the release date and the arrival date at Lower Granite Dam. The estimated survival rates are based on numbers of PIT-tagged fish counted at Lower Granite Dam and at dams downstream of Lower Granite Dam. The estimated survival rates account for fish that successfully pass through the turbines at Lower Granite Dam or are spilled over the dam, which are not counted in the fish bypass system at Lower Granite Dam. The procedure for estimating survival is presented in Hockersmith et al. (1999).

A release group is defined as the releases that were made during a specific time period. For example, Release Group 1 contains data for the releases that were made between May

28 and June 6 in 1995 through 1998. There are six release groups defined for the data in this report (Table 2-1).

Release		1995			1996			1997			1998		
Site	Release Group*	Release Date	Julian Date	Number Fish	Release Date	Julian Date	Number Fish	Release Date	Julian Date	Number Fish	Release Date	Julian Date	Number Fish
Clearwater	1				6/6	157	1,198	6/3	153	1,253	6/2	152	1,254
	2				6/13	164	1,166	6/10	160	1,238	6/9	159	1,274
	3				6/20	171	1,218	6/17	167	1,250	6/16	166	1,271
	4				6/27	178	1,189	6/24	174	1,250	6/23	173	1,264
	5				7/3	184	1,161	7/1	181	1,267	6/30	180	1,254
	6				7/10	191	1,211	7/8	188	1,269	7/7	187	1,288
Pittsburg Landing	1	5/31	150	1,353	6/6	157	1,189	6/3	153	1,262	6/2	152	1,277
	2	6/7	157	1,341	6/13	164	1,119	6/10	160	1,245	6/9	159	1,274
	3	6/14	164	1,326	6/20	171	1,189	6/17	167	1,243	6/16	166	1,251
	4				6/27	178	1,214	6/24	174	1,239	6/23	173	1,279
	5				7/3	184	1,220	7/1	181	1,251	6/30	180	1,273
	6				7/10	191	1224	7/8	188	1,238			
Billy Creek	1	6/1	151	1,220				6/3	153	1,247	6/2	152	1,262
	2	6/8	158	1,317				6/10	160	1,250	6/9	159	1,273
	3	6/15	165	1,124				6/17	167	1,244	6/16	166	1,261
	4							6/24	174	1,250	6/23	173	1,259
	5							7/1	181	1,245	6/30	180	1,249
	6							7/8	188	1,238	7/7	187	1,266
Asotin	3	6/19	169	2,778									
	4	6/27	177	2,489									
	5	7/5	185	3,523									
PD	1							5/28	148	6,955	6/4	155	7,028
								5/30	150	6,941	6/6	157	7,086
	2				6/13	164	6,870						
	3				6/20	171	6,929						

* Release groups are defined in text.

Table 2-1: Release dates and numbers of fish released for hatchery-raised, subyearling fall chinook salmon, 1995-1998.

A release series is the set of sequential releases made at one release site during one year. For example, the six releases made at the Clearwater site in 1996 are referred to as a release series.

Flow indices are used to describe flows over a period of time. For example, the 5th percentile flow index for a given site and a given release is the average of the average daily flows at Lower Granite Dam between the time of release and the arrival of the 5th percentile of the surviving fish. The 25th to 75th percentile flow index is the average of the average daily flows between the time of arrival of the 25th percentile and the time of arrival of the 75th percentile fish.

Previous studies have used 25th to 75th percentile flow indices for comparisons with survival (Smith et al., 1998; Muir et al., 1999). However, 5th percentile flow indices were used by Muir et al. (1999) to compare flow and estimated survival for subyearling fall chinook salmon. The reason for this is stated by Muir et al. (1999, pg. 7):

> Smith et al. (1998a) investigated relationships of environmental factors to survival of actively migrating yearling chinook salmon. Indices of exposure to factors at each dam for each group of PIT-tagged fish were defined as the average value of the factor during the period between the group's 25th and 75th percentiles of passage at the dam. However, indices defined over a 'middle of passage' period were not appropriate to relate to survival to Lower Granite Dam tailrace for subyearling fall chinook salmon released in free-flowing river sections above Lower Granite Dam. For subyearlings, mortality was relatively high in this river section, and much of the mortality probably occurred prior to the date of the 25th percentile of passage at Lower Granite Dam, which was as long as 44 days after the date of release. Therefore, the middle-of-passage index is inappropriate, since many fish in the release group never experienced the conditions prevailing on the date of 25th percentile of passage; they were already dead.

The 5th percentile flow indices represent earlier portions of the hydrograph than the 25th to 75th percentile flow indices (Figure 2-2). The 5th percentile flow indices for earlier releases are therefore larger values (during the subyearling migration period) than corresponding 25th to 75th percentile flow indices.

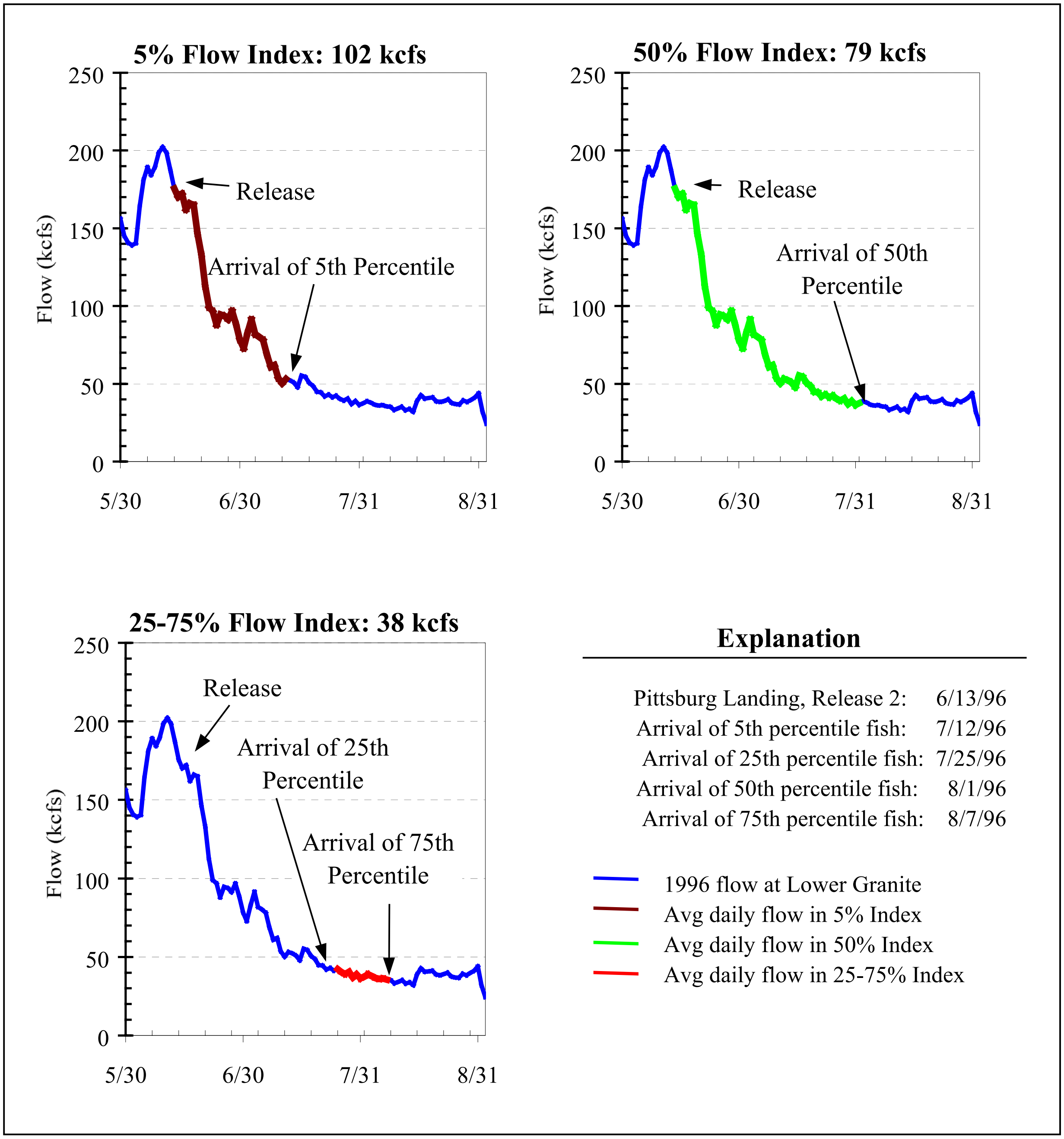

Figure 2-2: Flow indices (kcfs) for 5th, 50th, and 25th to 75th percentile arrivals at Lower Granite Dam for the release made at the Pittsburg Landing site on June 13, 1996.

3. Analysis and Results

This section provides comparisons of various combinations of flow, estimated survival, flow and temperature indices, and travel times. The following figures and comparisons include data describing: (1) annual and seasonal hydrographs and water temperature histories; (2) estimated survival by release and 5th percentile flow indices; (3) estimated survival and 5th percentile temperature indices; (4) estimated survival versus release date; (5) estimated survival and release groups by release site; (6) travel times from release to Lower Granite Dam; and (7) arrival dates of subyearling fall chinook detected at Lower Granite Dam.

3.1. Flow Rates and Water Temperatures at Lower Granite Dam

A hydrograph and history of water temperatures at Lower Granite Dam are shown in Figure 3.1-1 for the period from 1995 through 1998. In general, peak flows occurred in May and June, and peak water temperatures occurred in August and early September.

Seasonal hydrographs, temperatures, and spill rates are presented in Figures 3.1-2 through 3.1-5 for the period 1995 through 1998. The hydrographs represent total flow at Lower Granite Dam, consisting of the controlled discharge through the dam as well as spill over the dam's spillway.

These hydrographs include water that is released to augment flows in the lower Snake River. The current annual level of flow augmentation consists of 427,000 acre-feet of water from the upper Snake River, 110,000 acre-feet from Brownlee Reservoir during the spring, 235,000 acre-feet from Brownlee Reservoir during the summer, and 1.2 million acre-feet from Dworshak Reservoir. Figures 3.1-2 through 3.1-5 show flow augmentation to the Clearwater and Snake Rivers.

The flow rates at Lower Granite Dam from 1995 through 1998 are compared in Figure 3.1-6. The largest peak flow, and the peak of longest duration, was experienced in 1997. The lowest peak flow occurred in 1995.

Water temperatures typically rise during May, June, and early July (Figure 3.1-7). The highest water temperatures occurred in mid-July of 1995, early September of 1997, and mid-August of 1998. A decline in water temperatures followed by a second peak occurred in 1995, 1996, and 1998, presumably reflecting the influx of colder water from Dworshak Reservoir in August.

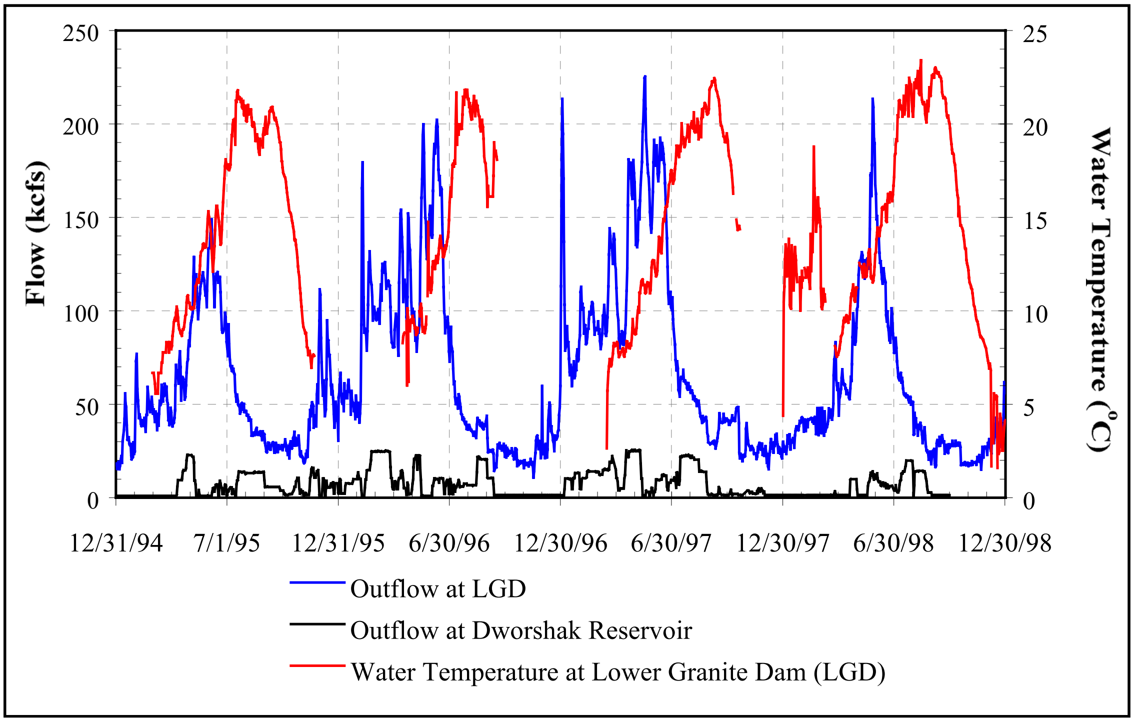

Figure 3.1-1: Outflow and water temperatures at Lower Granite Dam, 1995-1998.

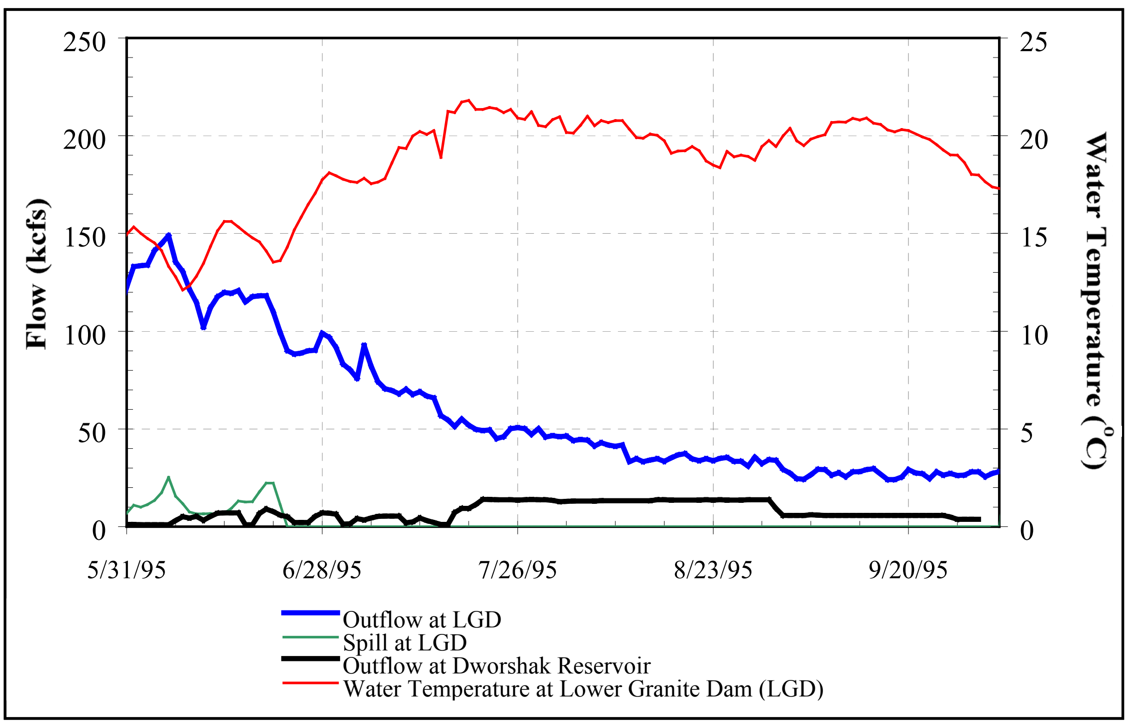

Figure 3.1-2: Outflow, spill, flow augmentation, and water temperatures at Lower Granite Dam, 1995.

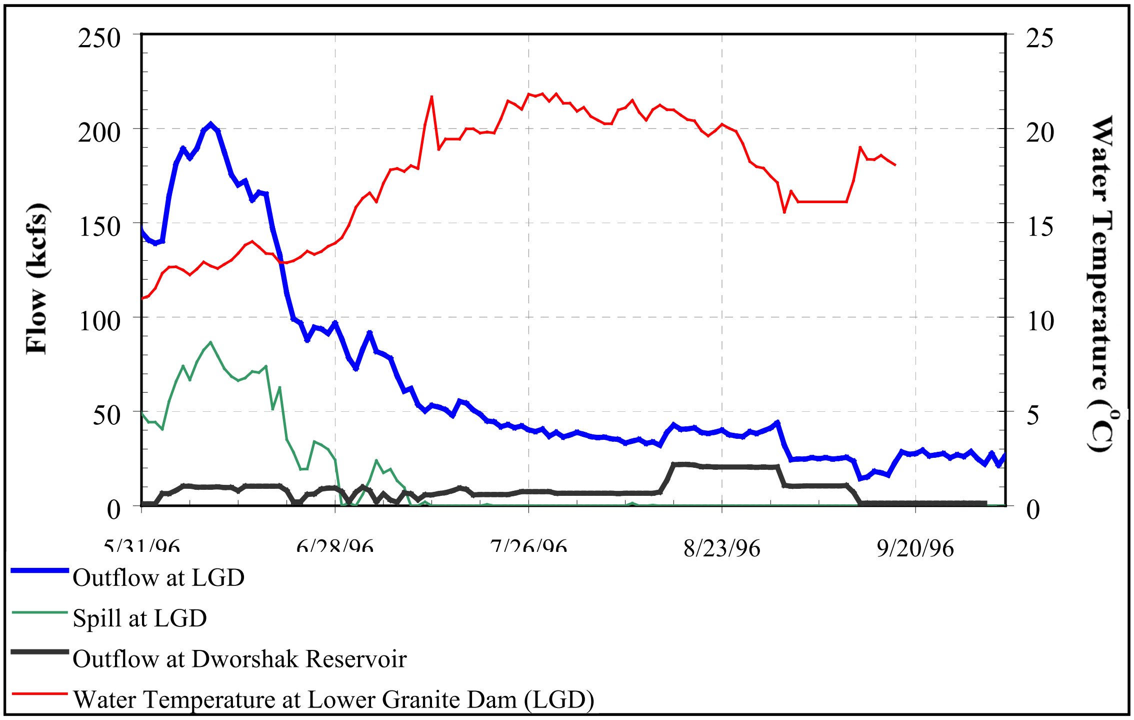

Figure 3.1-3: Outflow, spill, flow augmentation, and water temperatures at Lower Granite Dam, 1996.

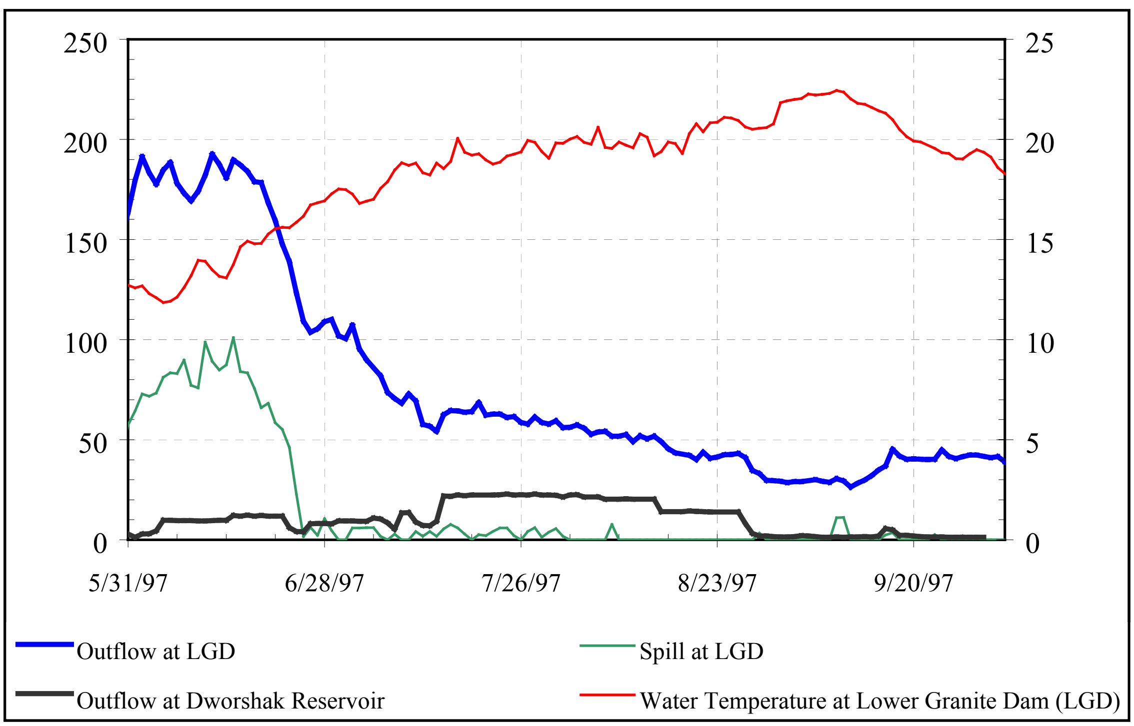

Figure 3.1-4: Outflow, spill, flow augmentation, and temperatures at Lower Granite Dam, 1997.

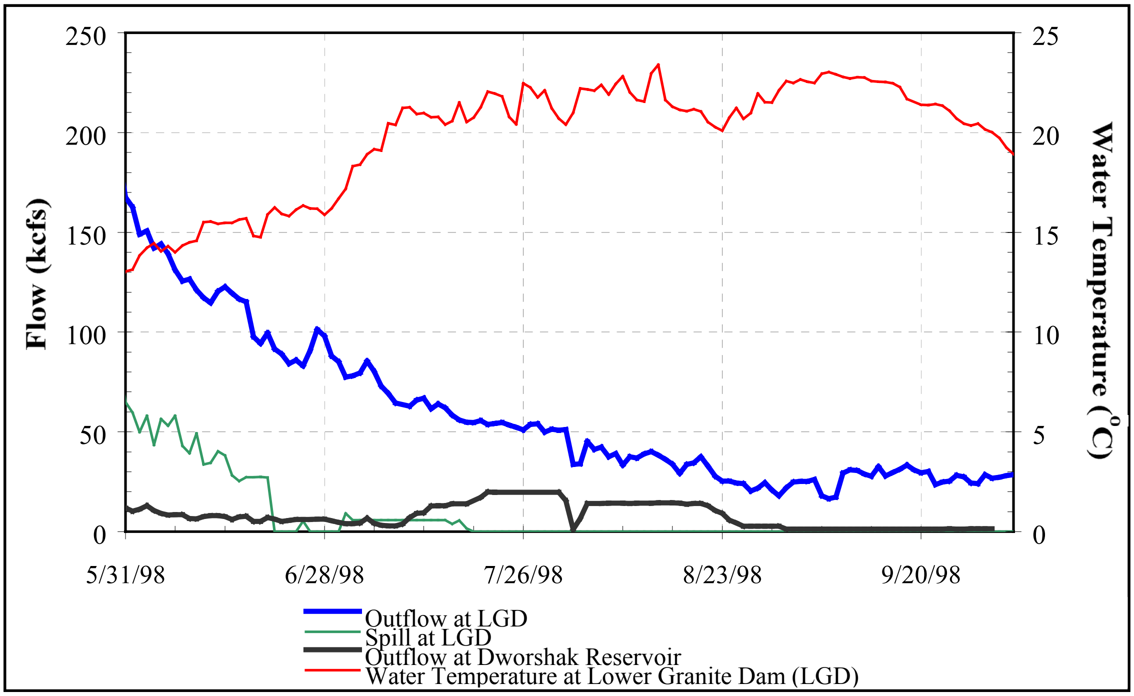

Figure 3.1-5: Outflow, spill, flow augmentation, and water temperature at Lower Granite Dam, 1998.

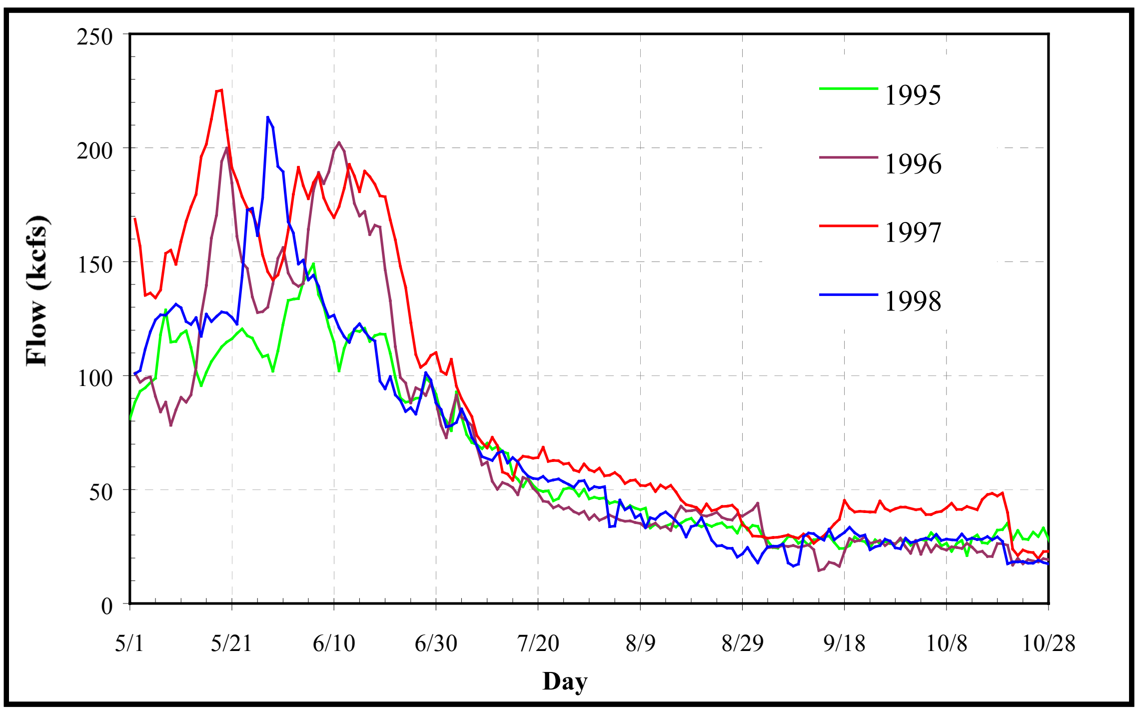

Figure 3.1-6: Outflows at Lower Granite Dam from approximately May 1 through October 31, 1995 through 1998.

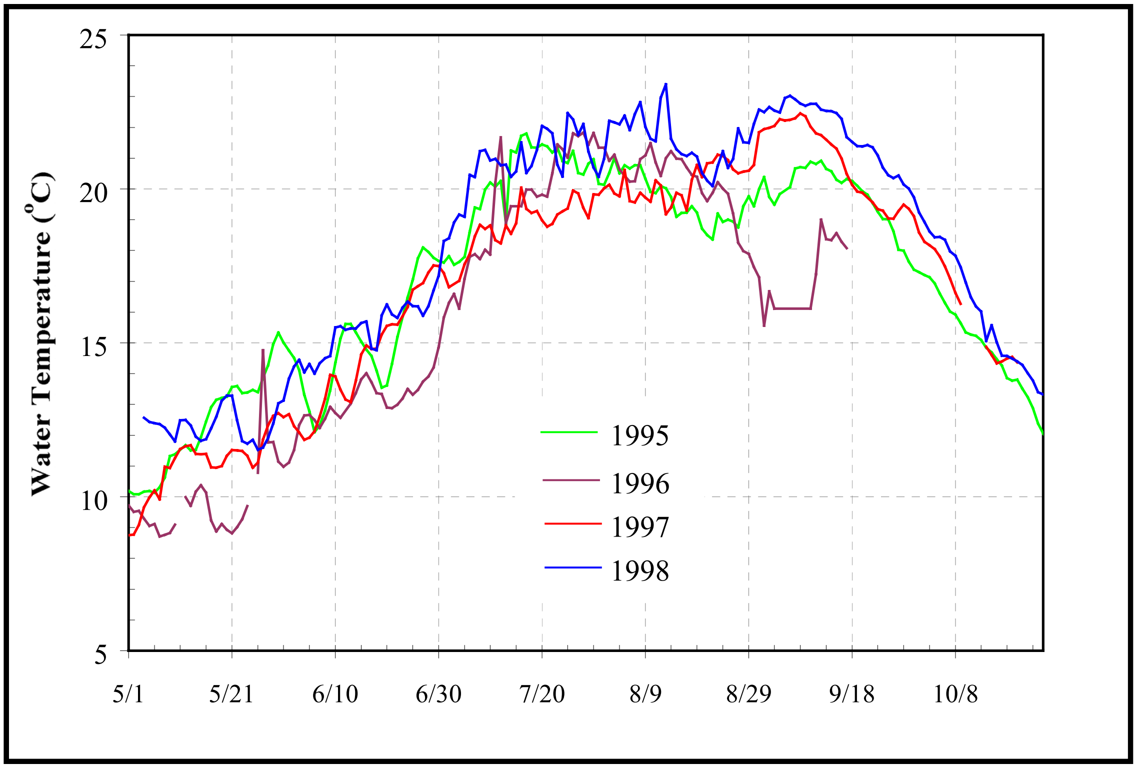

Figure 3.1-7: Water temperatures at Lower Granite Dam from May 1 through October 31, 1995 through 1998.

3.2. Comparison of Estimated Survival and 5th Percentile Flow Indices

Although use of 5th percentile flow indices is questionable (see Section 4.5), the evaluations herein use the 5th percentile flow indices to be consistent with the NMFS analyses. Regressions between estimated survival rates for hatchery-raised, subyearling fall chinook salmon (from points of release to Lower Granite Dam) and the 5th percentile flow indices for the 1995 through 1998 releases are shown in Figure 3.2-1. While there is an apparent positive correlation between estimated survival and outflow, additional analyses indicate this correlation may be strongly influenced by other factors and should not be used to infer a cause and effect relationship (see Section 4). Overall, the regression coefficient (R^2) for estimated survival correlated with 5th percentile flow indices for the 1995 through 1998 time period is 0.49. This overall value is lower than coefficients for individual years because of the variability between years.

In 1997, the Snake River experienced the highest daily average peak outflow (225 kcfs at Lower Granite Dam) for the period from 1995 through 1998 (Figure 3.2-1), and the peak outflow period was of longer duration than the other years. The apparent relationship between 5th percentile flow indices and estimated survival begins to have a different slope at flows greater than 120 kcfs. A second order polynomial regression was compared to the linear regression for the 1997 data. The second order polynomial regression results in a slightly larger correlation coefficient (R^2 = 0.80) than that of the linear regression (R^2 = 0.76).

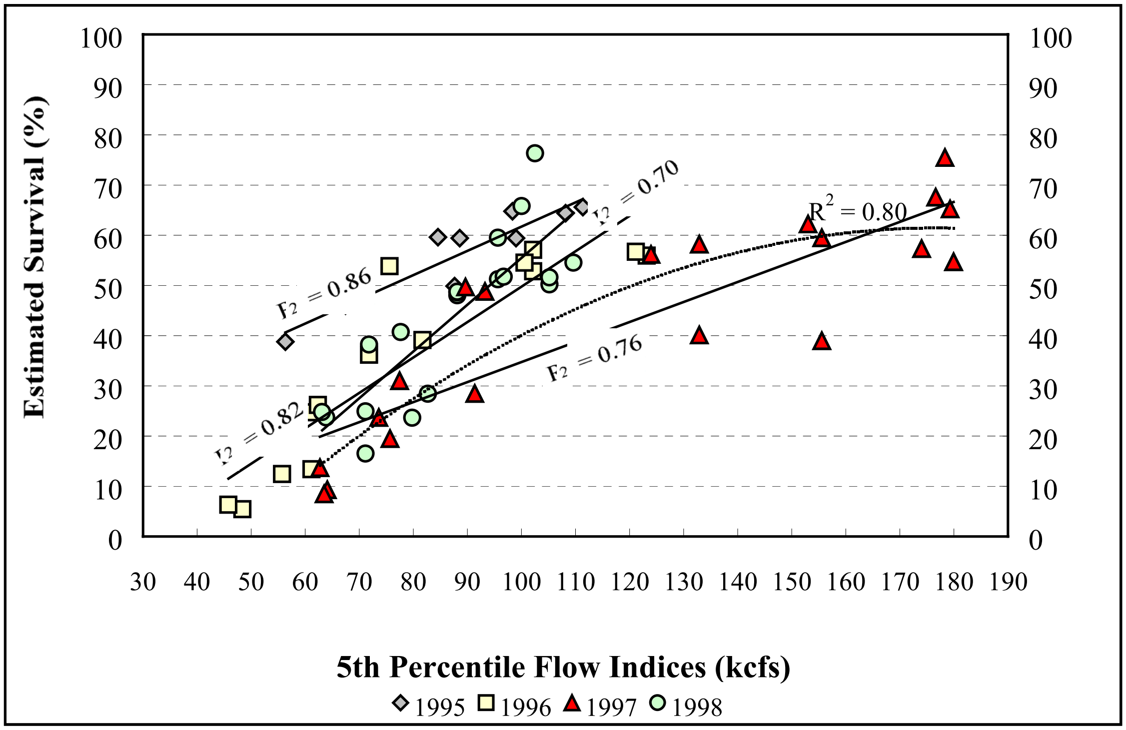

Figure 3.2-1: Estimated survival of hatchery-raised, fall chinook salmon versus 5th percentile flow indices.

3.3. Comparison of Estimated Survival and 5th Percentile Water Temperature Indices

Regressions between estimated survival (from points of release to Lower Granite Dam) and the 5th percentile water temperature indices are shown in Figure 3.3-1. The regression coefficients show a negative correlation between estimated survival and increasing water temperature; i.e., as water temperature increased, estimated survival decreased. The lowest temperatures were observed in 1997. Again, a second order polynomial regression resulted in a higher regression coefficient (R^2 = 0.82) than that of the corresponding linear regression (R^2 = 0.75) for the 1997 data. Overall, the regression coefficient for estimated survival correlated with 5th percentile water temperature indices for the 1995 through 1998 time period was 0.61. This overall value was lower than coefficients for individual years because of variability between years.

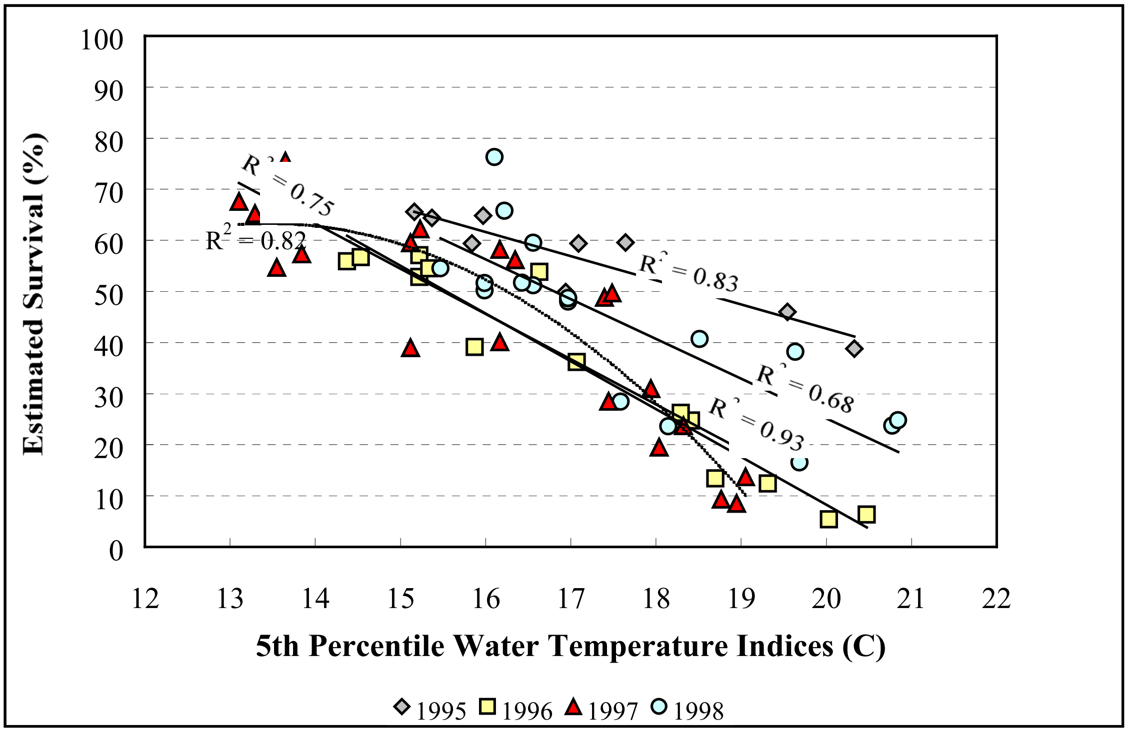

Figure 3.3-1: Estimated survival of hatchery-raised, fall chinook salmon versus 5th percentile water temperature indices.

3.4. Comparison of Estimated Survival and Date of Release

There is a strong negative correlation (Figure 3.4-1) between estimated survival to Lower Granite Dam and date of release for hatchery-raised, fall chinook salmon for all of the releases made in 1995 through 1998 ($R^2 = 0.79$). This value is considerably higher than the coefficients for estimated survival correlated with 5th percentile flow indices ($R^2 = 0.49$) and for estimated survival correlated with 5th percentile water temperature indices ($R^2 = 0.61$).

Estimated survival levels for 1995 are of limited significance because there were only nine releases that year (Figure 3.4-2). For 1996 releases in both the Snake and Clearwater Rivers, estimated survival rates are congruent (Figure 3.4-3). The rates are less congruent in 1997 when the Clearwater releases had lower survival rates than the Snake River releases (Figure 3.4-4), and in 1998 when some of the Clearwater releases had slightly higher survival rates than the releases on the Snake River (Figure 3.4-5). Although there are some differences in estimated survival rates between release sites, the correlation between estimated survival and date of release is the strongest overall relationship observed.

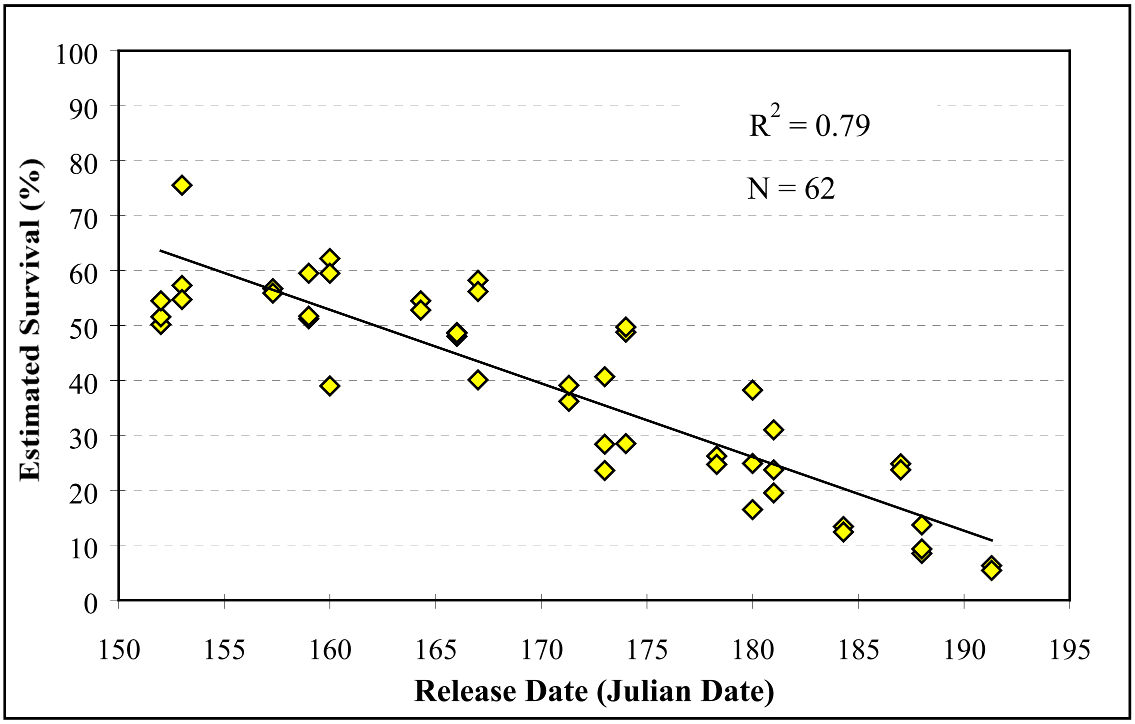

Figure 3.4.1: Estimated survival versus release date, 1995-1998.

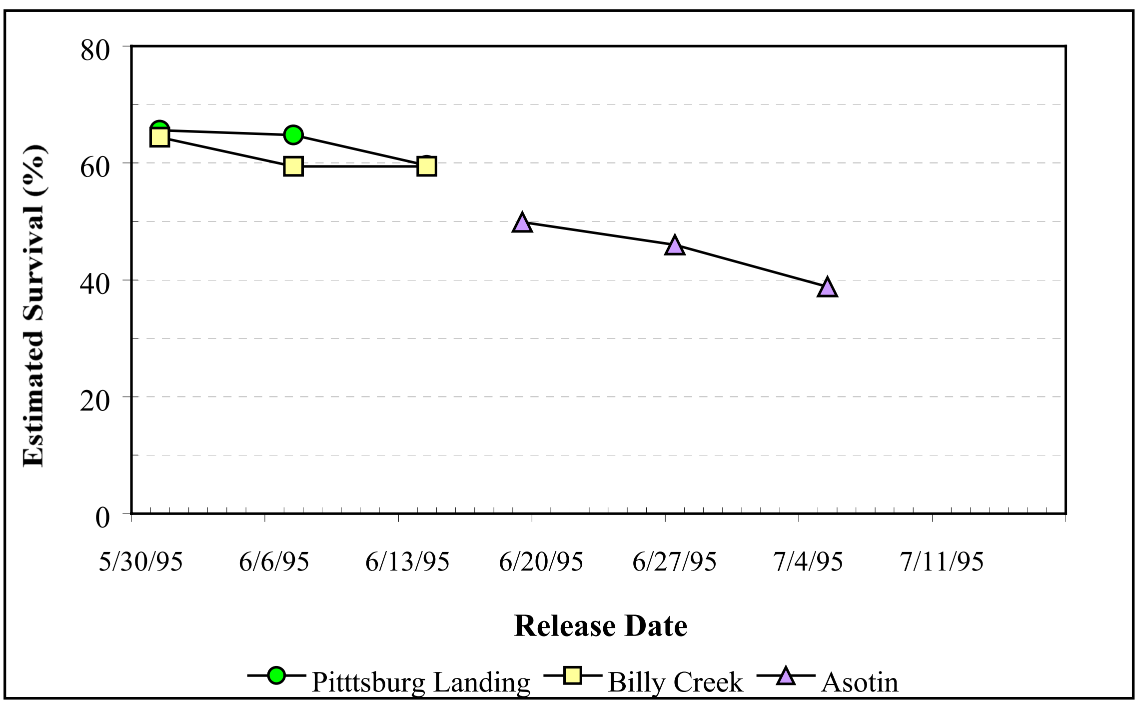

Figure 3.4-2: Estimated survival by release site, 1995.

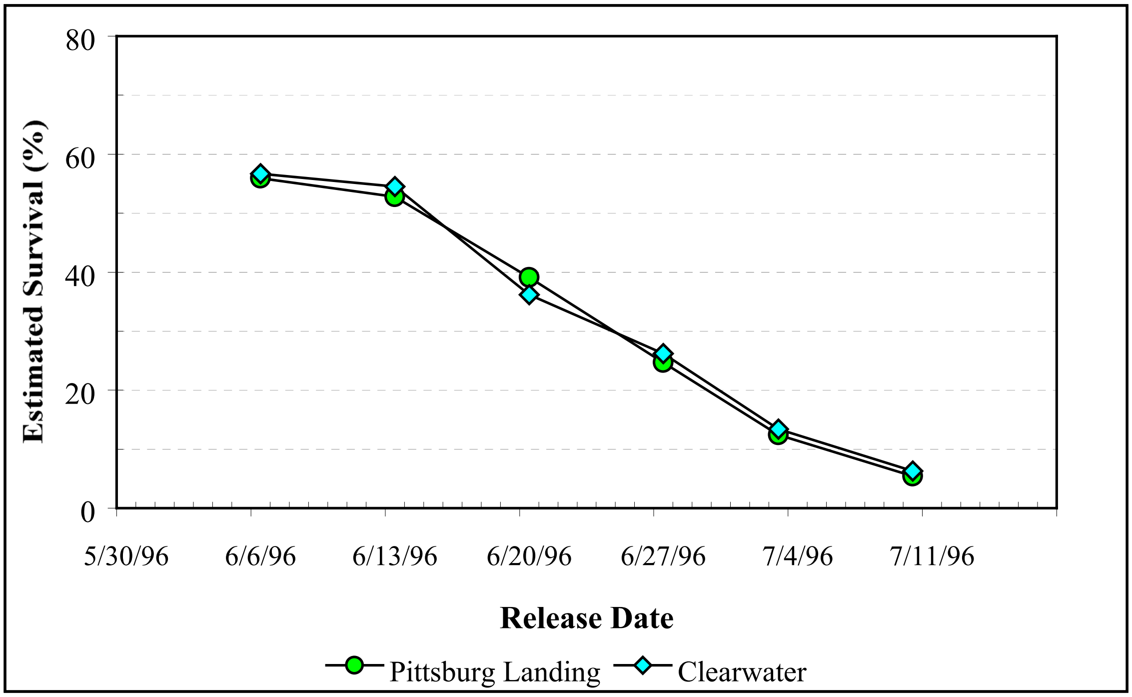

Figure 3.4-3: Estimated survival by release site, 1996.

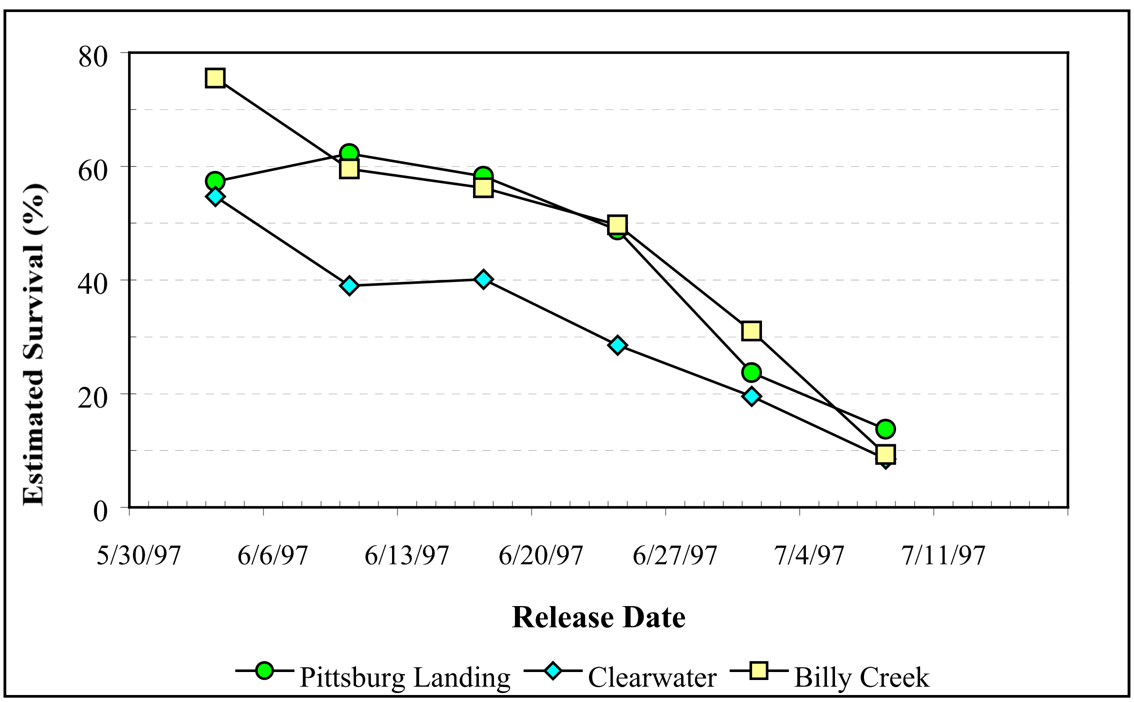

Figure 3.4-4: Estimated survival by release site and year, 1997.

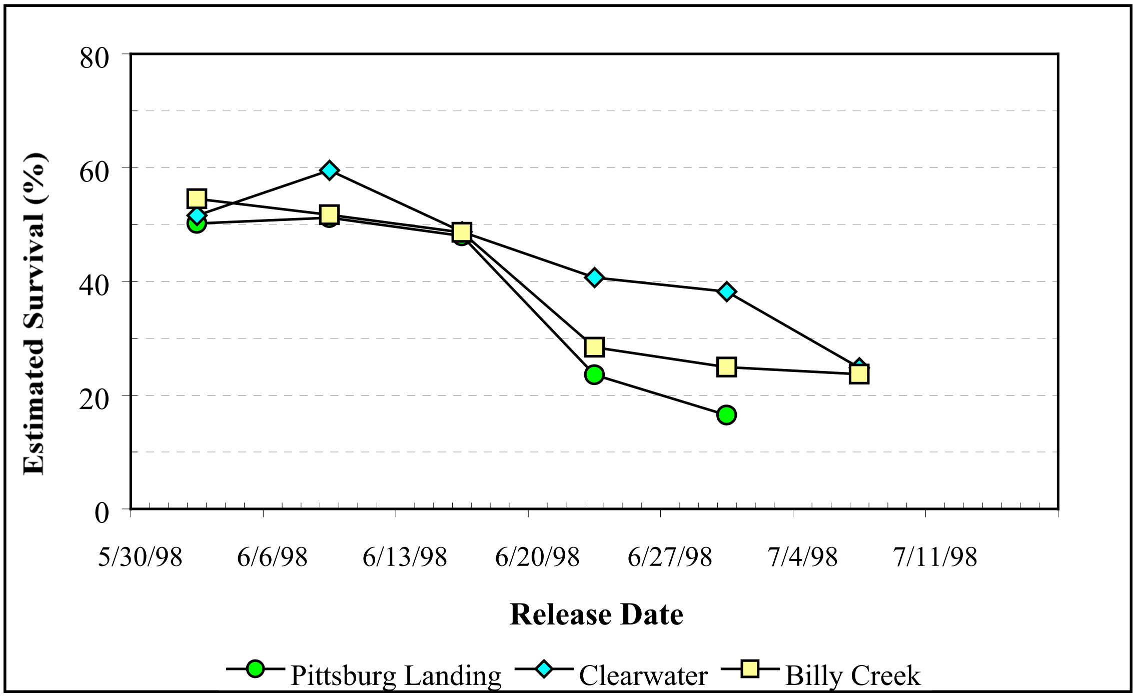

Figure 3.4-5: Estimated survival by release site and year, 1998.

3.5. Comparison of Estimated Survival and Release Groups by Release Site

The estimated survival by release group during the period 1995 through 1998 is shown in Figures 3.5-1 through 3.5-3. The estimated survival rates for the groups released at the Pittsburg Landing site were slightly higher in 1995[4] than in 1996 and 1997 (Figure 3.5-1). For all six release groups, the estimated survival rates from the 1997 releases at the Pittsburg Landing site were higher than the 1996 and 1998 releases.

Estimated survival rates for groups released at the Clearwater site were higher in 1998 than in 1996 and 1997 for 5 of the 6 releases (Figure 3.5-2). In general, the estimated survival rates for the releases at the Billy Creek site have similar patterns to the releases at the Pittsburg Landing site (Figure 3.5-3). Estimated survival rates were higher for 1995 and 1997 than for 1998 (there were no releases at the Billy Creek site in 1996).

These analyses show that there is some variation in estimated survival rates from year to year and between release sites. The reason(s) for the observed variations are not known.

[4] There were only three releases from the Pittsburg Landing site in 1995.

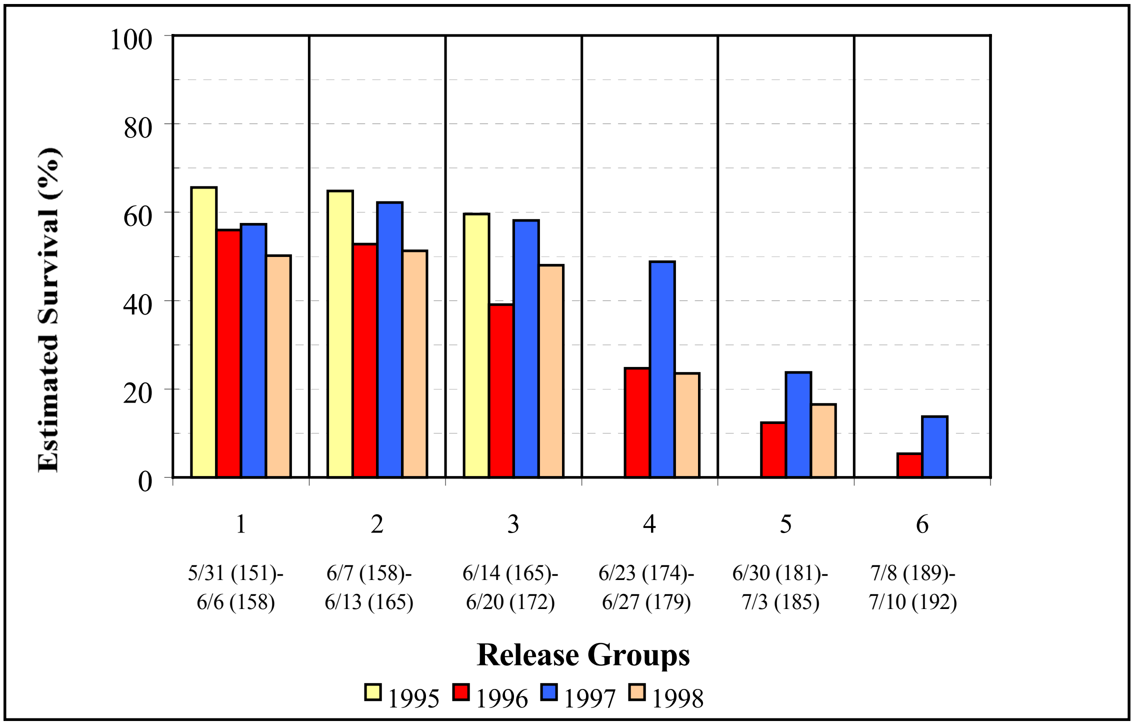

Figure 3.5-1: Estimated survival versus release groups for the Pittsburg Landing site, 1995-1998.

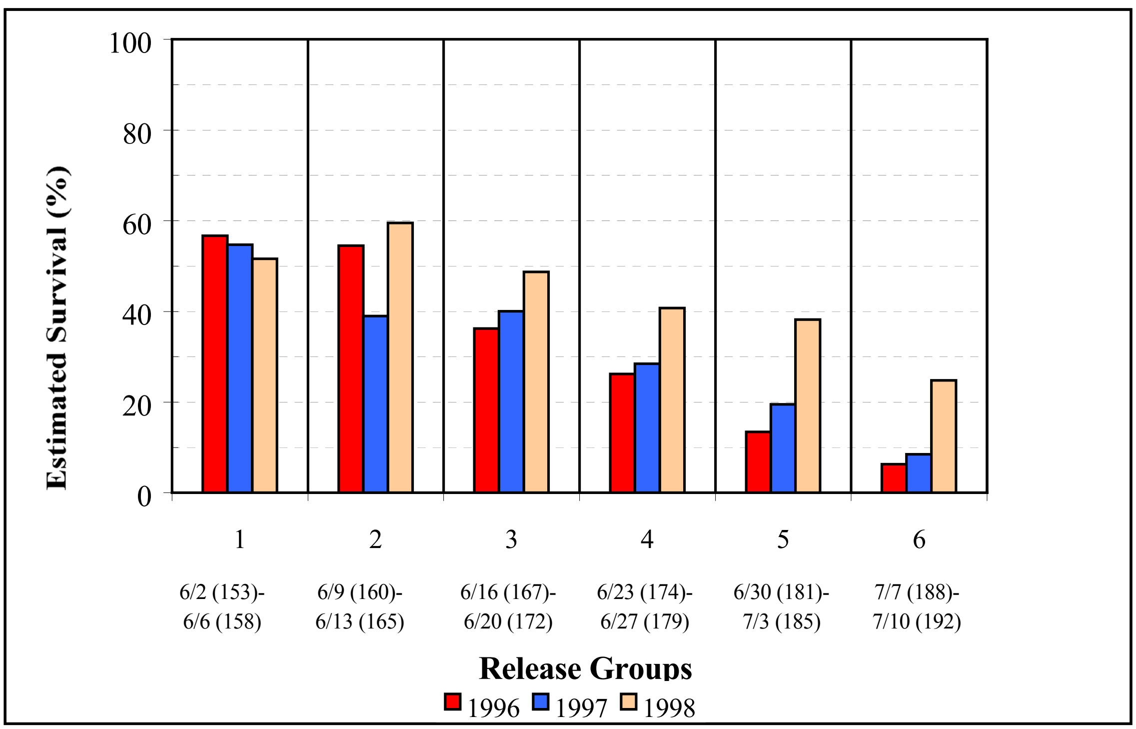

Figure 3.5-2: Estimated survival versus release groups for the Clearwater site, 1996-1998.

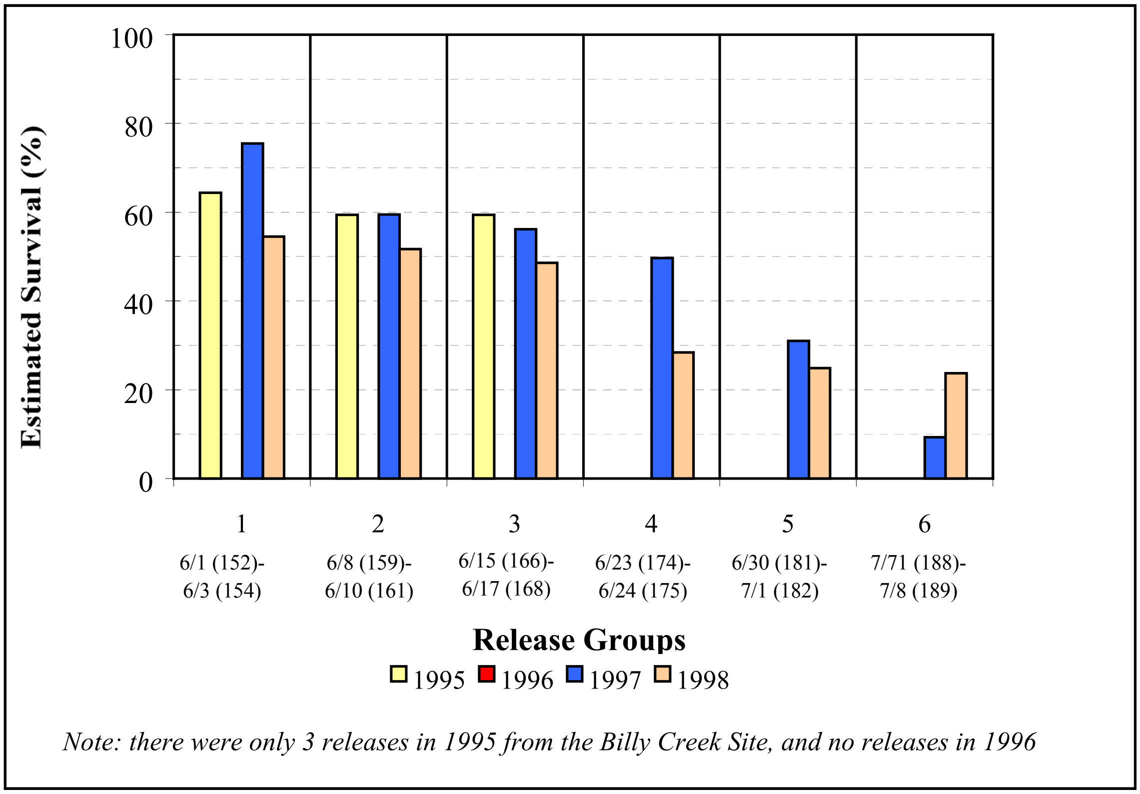

Figure 3.5-3: Estimated survival versus release groups for the Billy Creek site, 1995-1998.

3.6. Subyearling Fall Chinook Salmon Travel Times and Numbers of Detections

This section presents the following data:

1. Distribution curves for hatchery-raised, subyearling fall chinook salmon detected at Lower Granite Dam for the 1st, 3rd, and 6th releases for the years 1996 through 1998;

2. Cumulative detections of hatchery-raised, subyearling fall chinook salmon at Lower Granite Dam for the years 1996 through 1998; and

3. Flows, flow indices, travel times, and arrival dates for selected percentiles of surviving fish for the years 1996 through 1998.

3.6.1. Distribution curves for hatchery-raised, subyearling fall chinook salmon detected at Lower Granite Dam for the 1st, 3rd and 6th releases, 1996 through 1998

Distribution curves for surviving salmon detected from the 1st, 3rd, and 6th releases at the Pittsburg Landing, Clearwater, and Billy Creek release sites for the years 1996 through

1998 are shown in Figures 3.6.1-1 through 3.6.1-8. Flow and water temperatures at Lower Granite Dam as well as outflow from Dworshak Reservoir are also shown in these figures.

In general, the distribution curves for the early releases (1st and 3rd) are similar in shape. For example, compare the 1st and 3rd releases between the Clearwater and the Pittsburg Landing sites in 1996 (Figures 3.6.1-1 and 3.6.1-2). Detection data for the 1st and 3rd releases appear to be normally distributed to slightly skewed (either to the right or to the left). The 1st releases for 1997 appear to be more left-skewed than the 3rd releases (Figures 3.6.1-3 through 3.6.1-5).

The shapes of the distributions for the 6th releases are very different than the shapes of the distributions for the 1st and 3rd releases for all of the years. The 6th releases have distributions that are flat and elongated, indicating that migrations occur over long periods of time with fewer fish surviving than from the earlier releases.

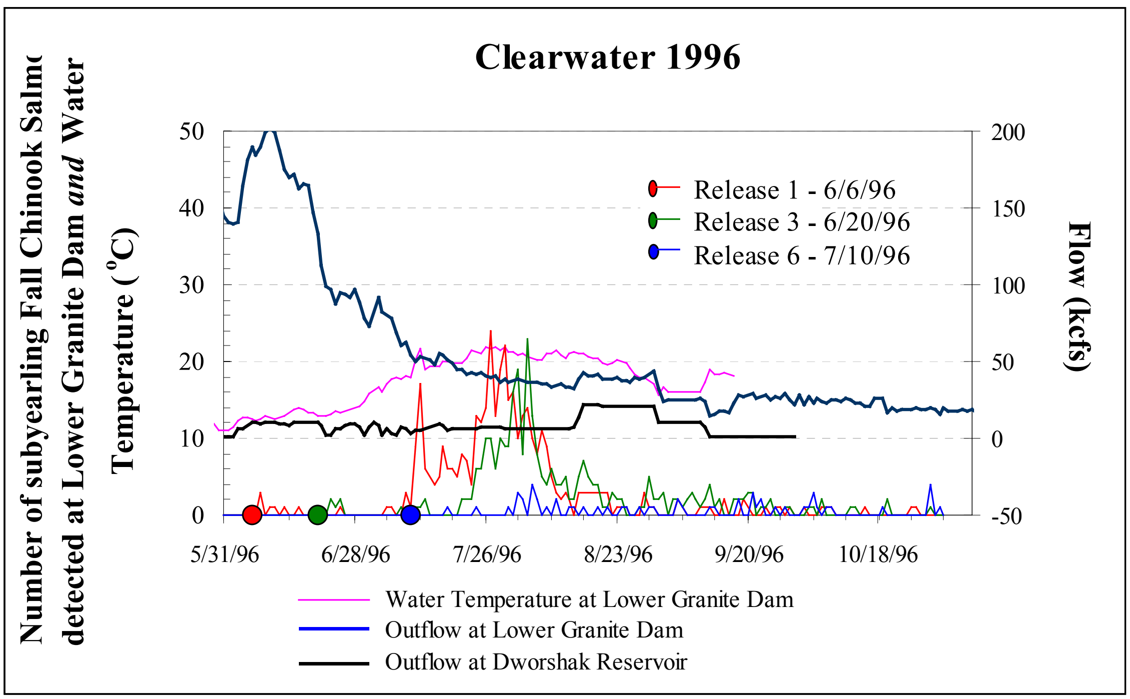

Figure 3.6.1-1: Distribution of hatchery-raised, subyearling fall chinook salmon released at the Clearwater site in 1996 and detected at Lower Granite Dam.

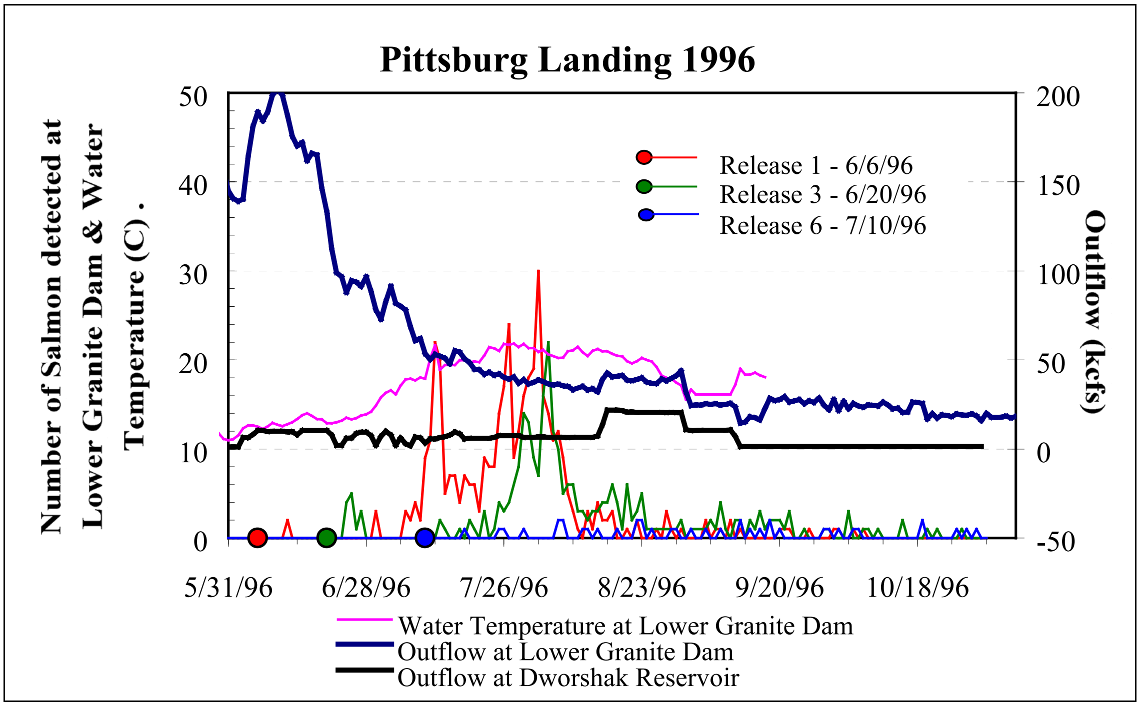

Figure 3.6.1-2: Distribution of hatchery-raised, subyearling fall chinook salmon released at the Pittsburg Landing site in 1996 and detected at Lower Granite Dam.

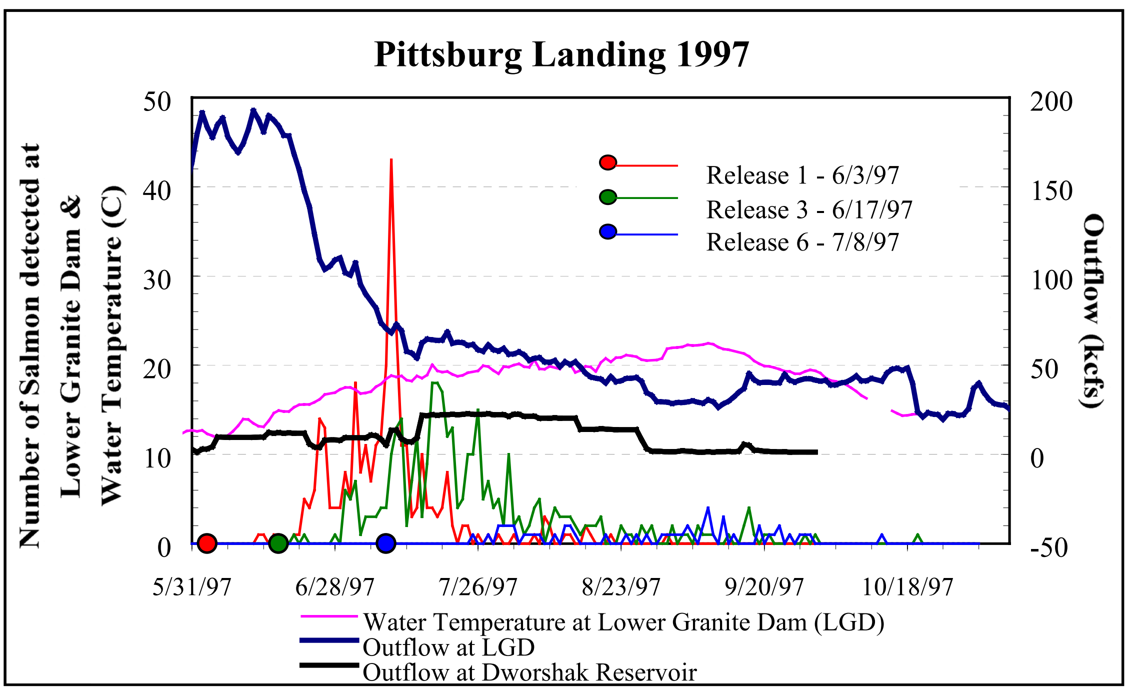

Figure 3.6.1-3: Distribution of hatchery-raised, subyearling fall chinook salmon released at the Pittsburg Landing site in 1997 and detected at Lower Granite Dam.

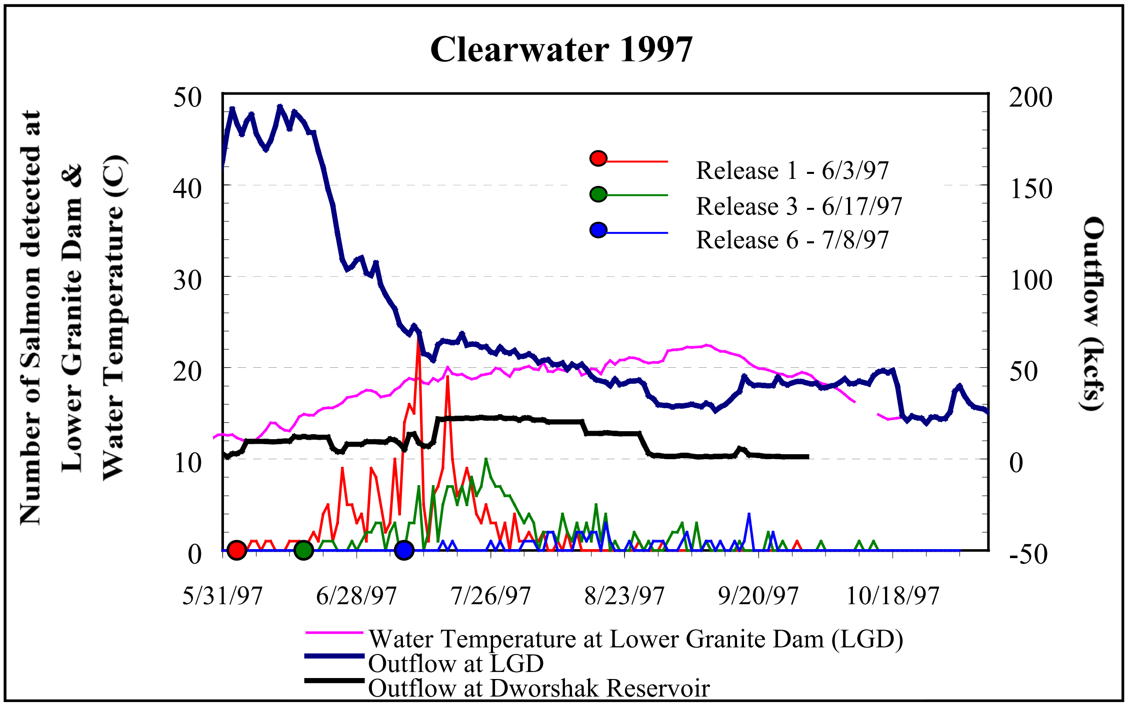

Figure 3.6.1-4: Distribution of hatchery-raised, subyearling fall chinook salmon released at the Clearwater site in 1997 and detected at Lower Granite Dam.

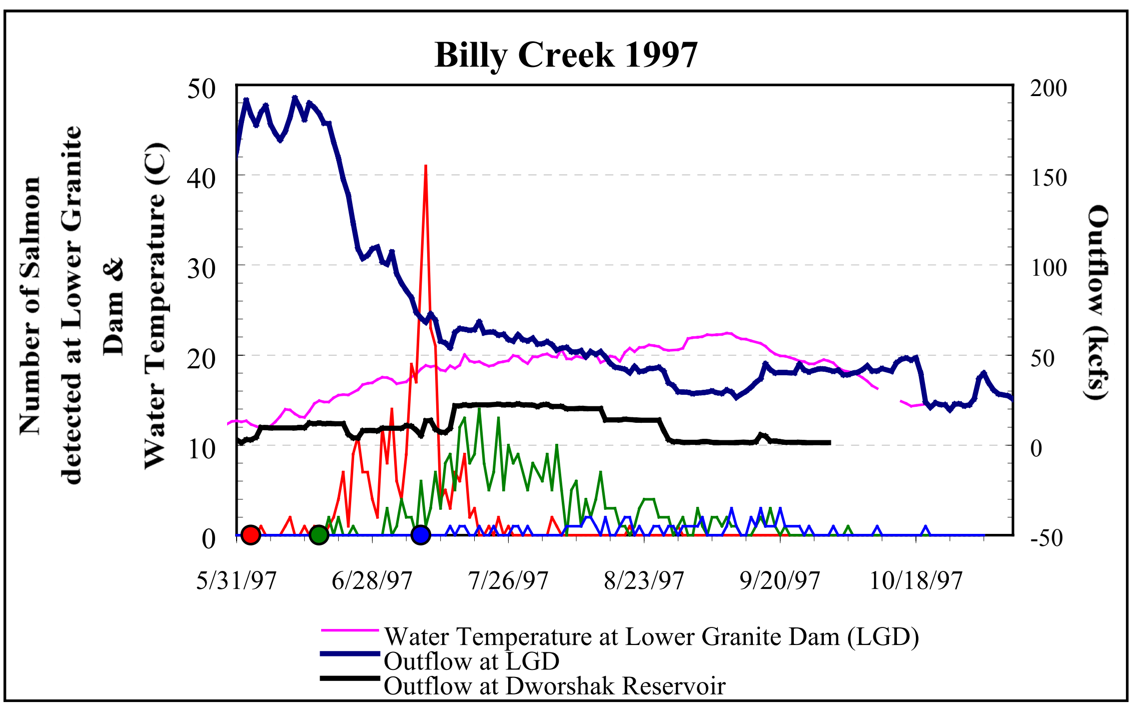

Figure 3.6.1-5: Distribution of hatchery-raised, subyearling fall chinook salmon released at the Billy Creek site in 1997 and detected at Lower Granite Dam.

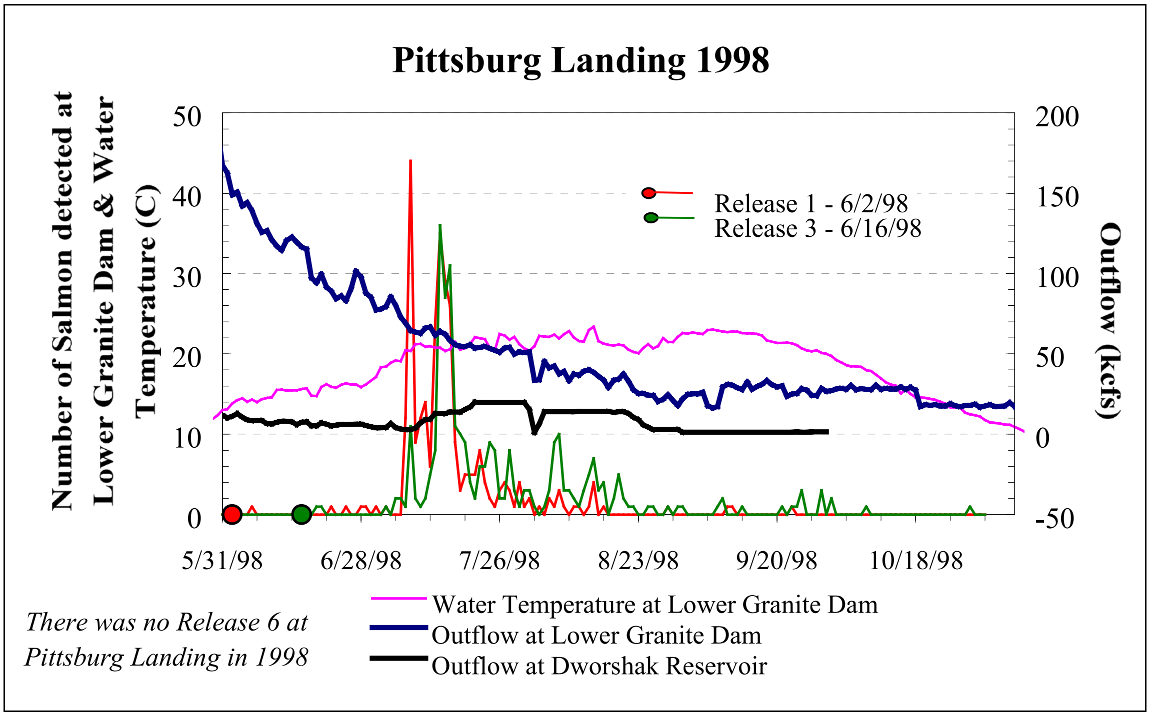

Figure 3.6.1-6: Distribution of hatchery-raised, subyearling fall chinook salmon released at the Pittsburg Landing site in 1998 and detected at Lower Granite Dam.

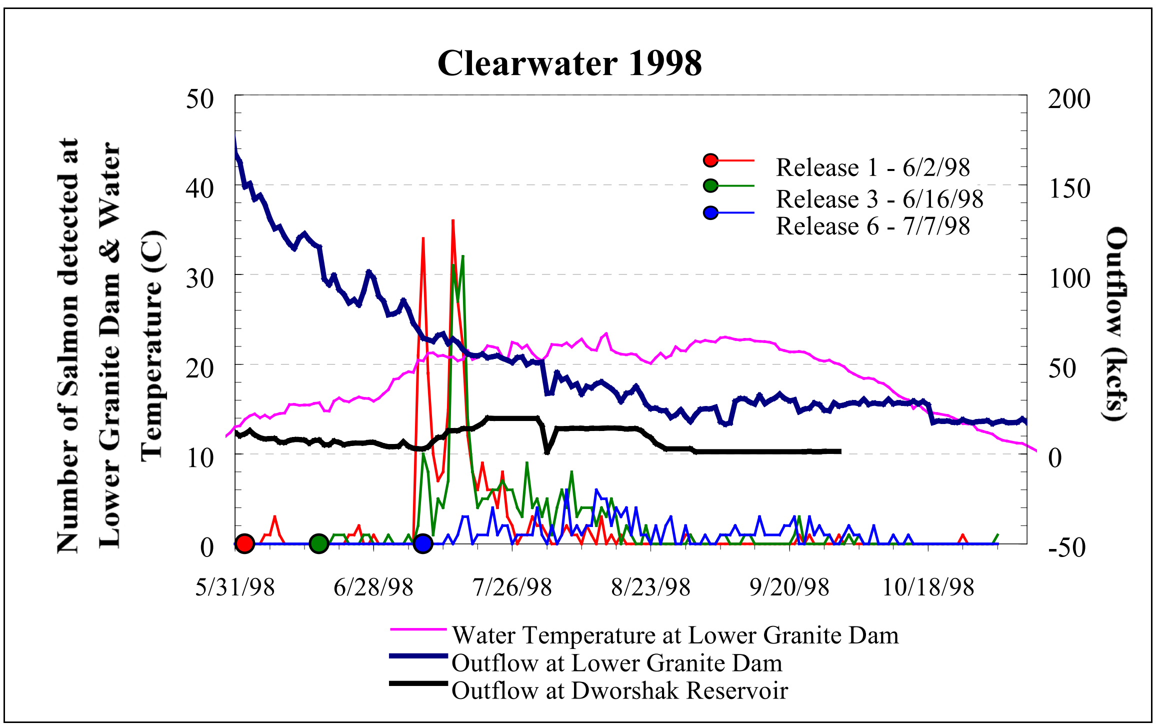

Figure 3.6.1-7: Distribution of hatchery-raised, subyearling fall chinook salmon released at the Clearwater site in 1998 and detected at Lower Granite Dam.

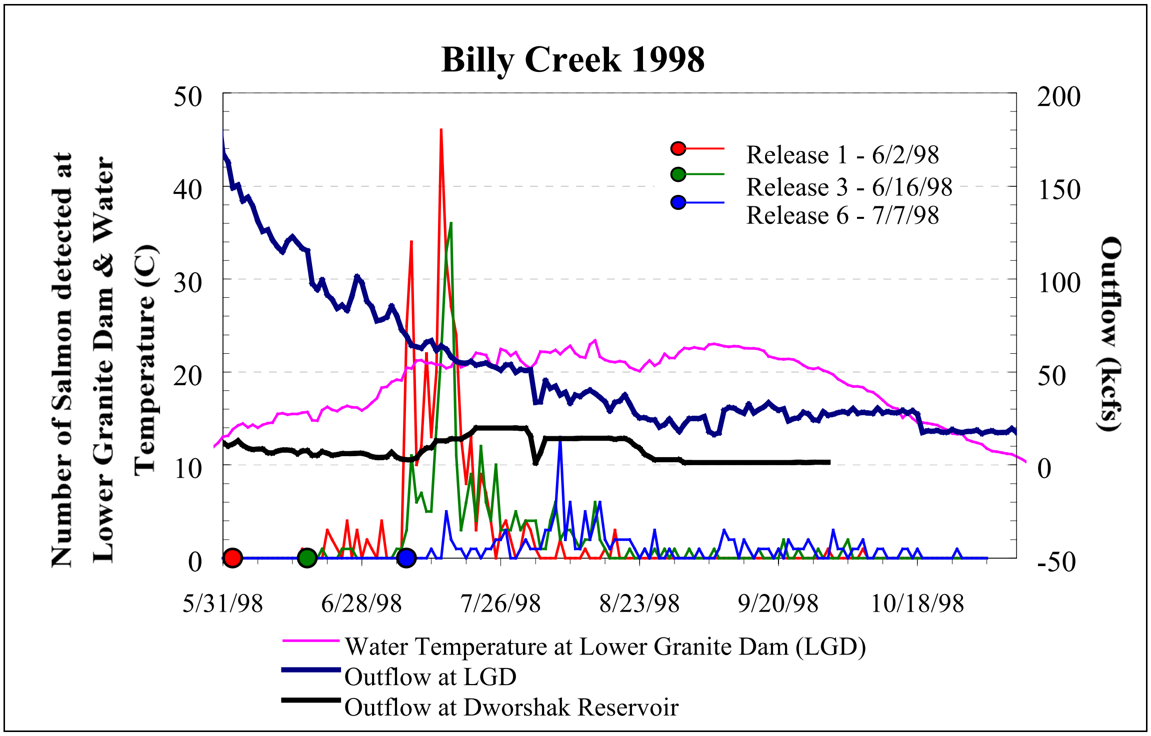

Figure 3.6.1-8: Distribution of hatchery-raised, subyearling fall chinook salmon released at the Billy Creek site in 1998 and detected at detected at Lower Granite Dam.

3.6.2. Cumulative detections of subyearling fall chinook salmon at Lower Granite Dam for the 1st , 3rd, and 6th releases, 1996 through 1998.

Cumulative detections of subyearling fall chinook salmon at Lower Granite Dam from the 1st, 3rd, and 6th releases are presented in Figures 3.6.2-1 through 3.6.2-3. Cumulative detections from early releases generally form steeper curves, indicating that migration occurs during a relatively short time period. First and 3rd releases show more delay for the arrival of the 5th percentile fish than the 6th releases, which possibly is associated with the time required to reach physiological "readiness" to migrate. Cumulative detections from 6th releases were spread over a larger time period, indicating a more dispersed migration pattern.

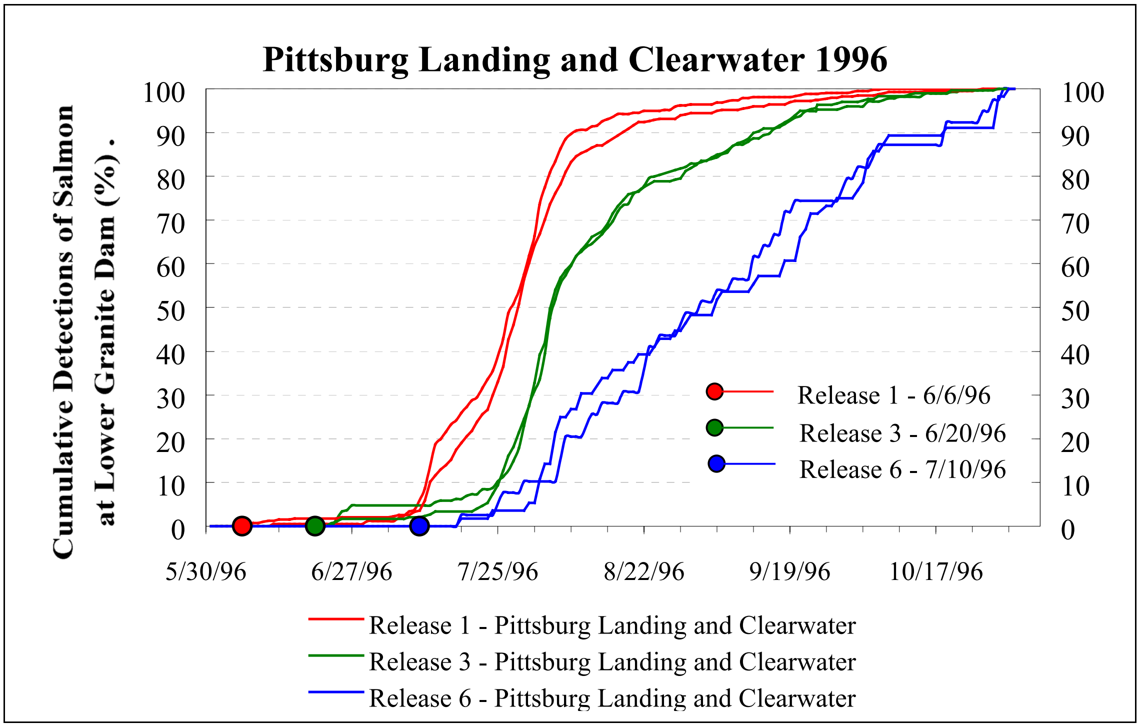

Figure 3.6.2-1: Cumulative detections of hatchery–raised, fall chinook salmon at Lower Granite Dam released from the Pittsburg Landing and Clearwater sites in 1996.

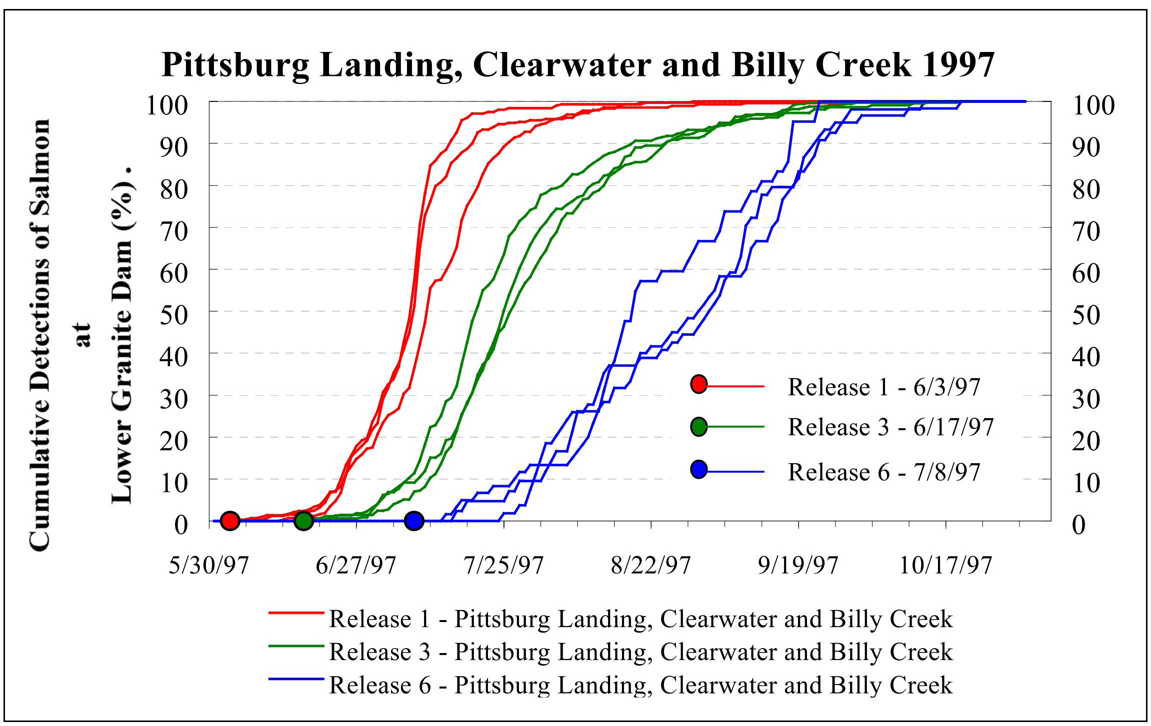

Figure 3.6.2-2: Cumulative detections of hatchery–raised, fall chinook salmon at Lower Granite Dam released from the Pittsburg Landing, Clearwater, and Billy Creek sites in 1997.

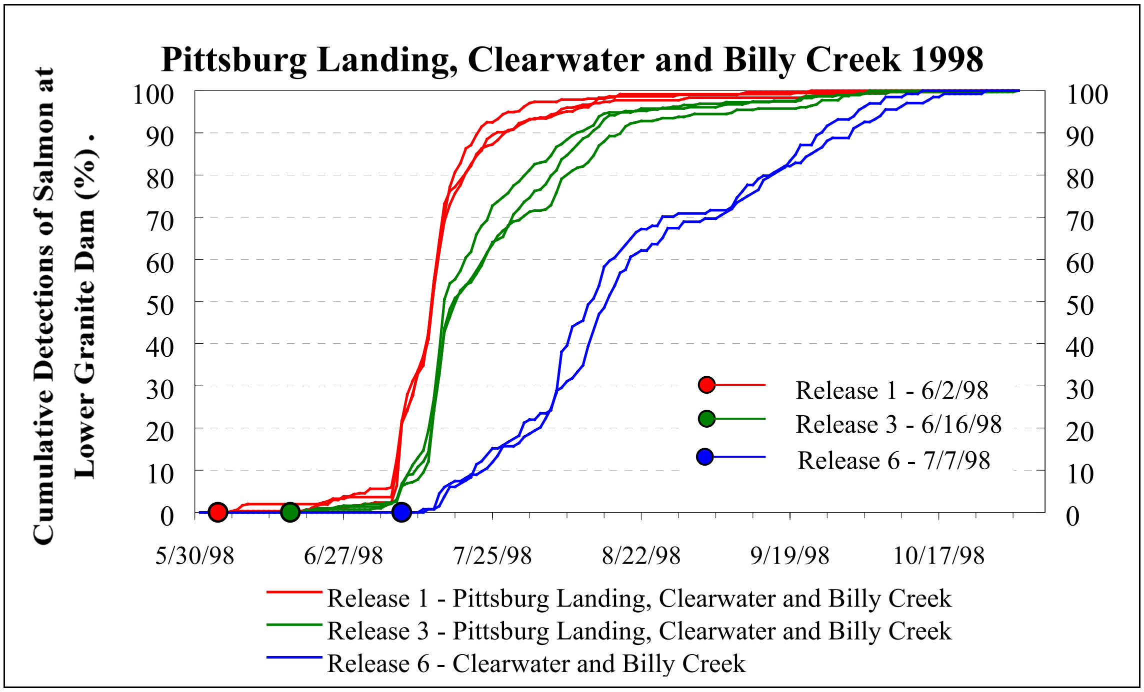

Figure 3.6.2-3: Cumulative detections of hatchery–raised, fall chinook salmon at Lower Granite Dam released from the Pittsburg Landing, Clearwater, and Billy Creek sites in 1998.

3.6.3. Flows Rates, Flow Indices, Travel Times, and Arrival Dates

This section presents a series of graphs showing flow rates, flow indices, travel times, and arrival dates for selected percentiles of surviving fish. Figures 3.6.3-1 through 3.6.3-16 display flows, flow indices, water temperatures, travel times, and arrival dates for selected percentiles of surviving fish for the Clearwater and Snake River releases for 1996 through 1998. These figures are arranged in sequences according to release site and year. For example, Figures 3.6.3-1 and 3.6.3-2 show the flows, flow indices, water temperatures, travel times, and arrival dates for releases at the Pittsburg Landing site in 1996. Figure 3.6.1-17 shows the median of the travel times for the 50th percentile fish and the median of the 50th percentile flow indices by release group. Travel times (in days) for the 5th, 25th, 50th, and 75th percentile fish in the 1st and 6th releases are presented in Table 3.6.3-1.

The following observations and interpretations are made from these graphs (discussion of each numbered point follows):

1) Travel times for the 5th and 10th percentile surviving fish decreased for each release series[5], despite decreasing flow rates. Travel times for the 25th percentile surviving

[5] The term “release series” refers to sequential releases during one year at one site.

fish decreased or remained nearly the same (except for the 1997 Billy Creek series, which experienced a slight increase in travel time).

2) There was no significant difference in the median travel times for the six weekly release groups for the 50^{th} percentile surviving fish at the 95 percent confidence interval despite a decrease in the median 50^{th} percentile flow indices of about 48 percent from the 1^{st} to the 6^{th} releases (99 kcfs to 51 kcfs).

3) The arrival dates for some of the surviving fish percentiles were nearly the same despite being released up to 14 days apart.

4) The effect of flow augmentation from Dworshak Reservoir on fall chinook salmon survival rates is unknown. An analysis of the 50^{th} percentile fish, Releases 1 through 4 in 1996 (these fish arrived at Lower Granite Dam before augmentation from Dworshak began) with Releases 1 through 4, 1998 (flow augmentation from Dworshak took place during the migration of these fish) showed that there was no statistical difference in estimated survival between the two years at the 95 percent confidence level.

Travel times for the 5^{th} and 10^{th} percentile surviving fish decreased for each release series despite decreasing flow rates. For example, the 5^{th} percentile surviving fish from the first Pittsburg Landing release arrived at Lower Granite Dam in 34 days (Figure 3.6.3-1). The 5^{th} percentile flow index during this time was 123 kcfs. The 5^{th} percentile surviving fish from the 6^{th} release arrived in 15 days. The 5^{th} percentile flow during these 16 days was 48 kcfs.

The median travel times for the 5^{th} percentile surviving fish in the 1^{st} releases[6] during the years 1996 through 1998 was 33 days (Table 3.6-1). The median travel time for the 5^{th} percentile fish from the 6^{th} releases was 16 days. **Thus, the median travel times for the 5^{th} percentile surviving fish from the 1^{st} releases was more than twice the median travel time of the 5^{th} surviving percentile fish from the 6^{th} releases, despite steadily decreasing flows.** This pattern was also observed for some of the 25^{th} percentile surviving fish. For example, the median travel time for the 25^{th} percentile surviving fish in the 1^{st} releases was 39 days (Table 3.6-1). The median travel time of the 25^{th} percentile surviving fish from the 6^{th} releases was 31 days, despite steadily decreasing flows.

Travel times for the 50^{th} percentile surviving fish generally decreased from the 1^{st} to the middle (3^{rd} or 4^{th}) releases, despite decreasing flows, then increased for later releases (Figures 3.6.3-1, -3, -11, -13 and -15). This pattern was also observed by NMFS (2000): "Typically, groups released around 13-15 June had the shortest travel times, and groups released earlier or later had longer travel times," and that "flow generally decreased

[6] Includes those release series in which there were five or six weekly releases.

throughout the period of subyearling chinook salmon migration." Median travel times in 1997 were an exception; the shortest travel times for the 50th percentile surviving fish were experienced by fish from the 2nd release (Figures 3.6.3-5, -7, and –9).

A compilation of the release data for individual sites showed that median travel times for the 50th percentile surviving fish from the six release groups had a much different pattern than the medians of the 50th percentile flow indices for those groups. While the median flow indices dropped steadily from 99 kcfs (1st release groups) to 51 kcfs (6th release groups), median travel times remained nearly the same for the four release groups, and rose slightly for the last two release groups (Figure 3.6.3-17).

The arrival dates for some of the percentiles of surviving fish were clustered. Figures 3.6.3-2, -4, -6, -8, -10, -12, -14, and -16 show the survival, release date, and arrival times of the 5th, 50th, and 90th percentile surviving fish. The 5th percentile surviving fish from several sequential releases arrived on a similar date. For example, the 5th percentile surviving fish from the first three weekly releases at the Pittsburg Landing site in 1998 (released on 6/2, 6/9, and 6/16) arrived within one day of each other (Figure 3.6.3-12). The arrivals of the 5th percentile surviving fish from the last three Pittsburg Landing releases in 1996 occurred at approximately the same time (Figure 3.6.3-2). In fact, the arrival of the 5th percentile surviving fish from the 6th release actually occurred prior to the arrival of the 5th percentile surviving fish from the previous two releases. This pattern of similar arrival times for the 5th percentile surviving fish released up to 14 days apart was also observed in releases from the Clearwater site in 1996 and 1998, and the Billy Creek site in 1997 and 1998.

Some of the 50th percentile surviving fish from sequential releases arrived in clusters despite different release times. This pattern was observed in the 1st and 2nd and in the 3rd and 4th releases from the Clearwater site in 1996 (Figure 3.6.3-4), the first two releases from the Clearwater site in 1997 (Figure 3.6.3-8), the first two releases from Billy Creek in 1997 (Figure 3.6.3-10), the first three releases from the Pittsburg Landing site in 1998 (Figure 3.6.3-12), the first three releases from the Clearwater site in 1998 (Figure 3.6.3-14), and the first three and the last two releases from the Billy Creek site in 1998 (Figure 3.6.3-16).

Some of the arrival dates for the 90th percentile surviving fish from different releases were also aggregated despite weekly intervals between release times. Examples of this include the last two releases from the Pittsburg Landing site in 1997 (Figure 3.6.3-6) as well as the first two and the last two releases from the Clearwater site in 1997 (Figure 3.6.3-8). Conversely, some of the arrival dates for the 90th percentile surviving fish were more spread out than the time intervals between releases. Examples of this include the arrivals of the 90th percentile surviving fish from the 2nd and 3rd releases from the Clearwater site in 1996 (Figure 3.6.3-4), the 4th and 5th releases from the Pittsburg Landing site in 1997

(Figure 3.6.3-6), the 3rd and 4th releases from the Pittsburg Landing site in 1998 (Figure 3.6.3-10), and the 4th and 5th releases from the Billy Creek site in 1998 (Figure 3.6.3-16).

Finally, the effects of increased flow from Dworshak Reservoir in mid-August of 1996 and in mid-July of 1997 and 1998 could not be determined using available data. However, a portion of the data was analyzed by comparing releases that had reached Lower Granite Dam before flow augmentation began with releases that experienced, at least in part, flow augmentation from Dworshak Reservoir. In 1996, the 50th percentile surviving fish from the first four releases from the Clearwater and the Pittsburg Landing sites arrived at Lower Granite Dam before flow augmentation began at Dworshak Reservoir. In 1998, flow augmentation from Dworshak began earlier than in 1996. Thus, the 50th percentile surviving fish from the first four releases at the Clearwater and the Pittsburg Landing sites in 1998 migrated during the time period when flow augmentation from Dworshak Reservoir was in the Clearwater and Snake Rivers. Although the travel times for the 50th percentile fish for the first four releases were significantly greater in 1996 than in 1998 at the 95 percent confidence level, the 50th percentile flow indices, 50th percentile water temperature indices, and estimated survival were not significantly different between 1996 and 1998 at the 95 percent confidence level.

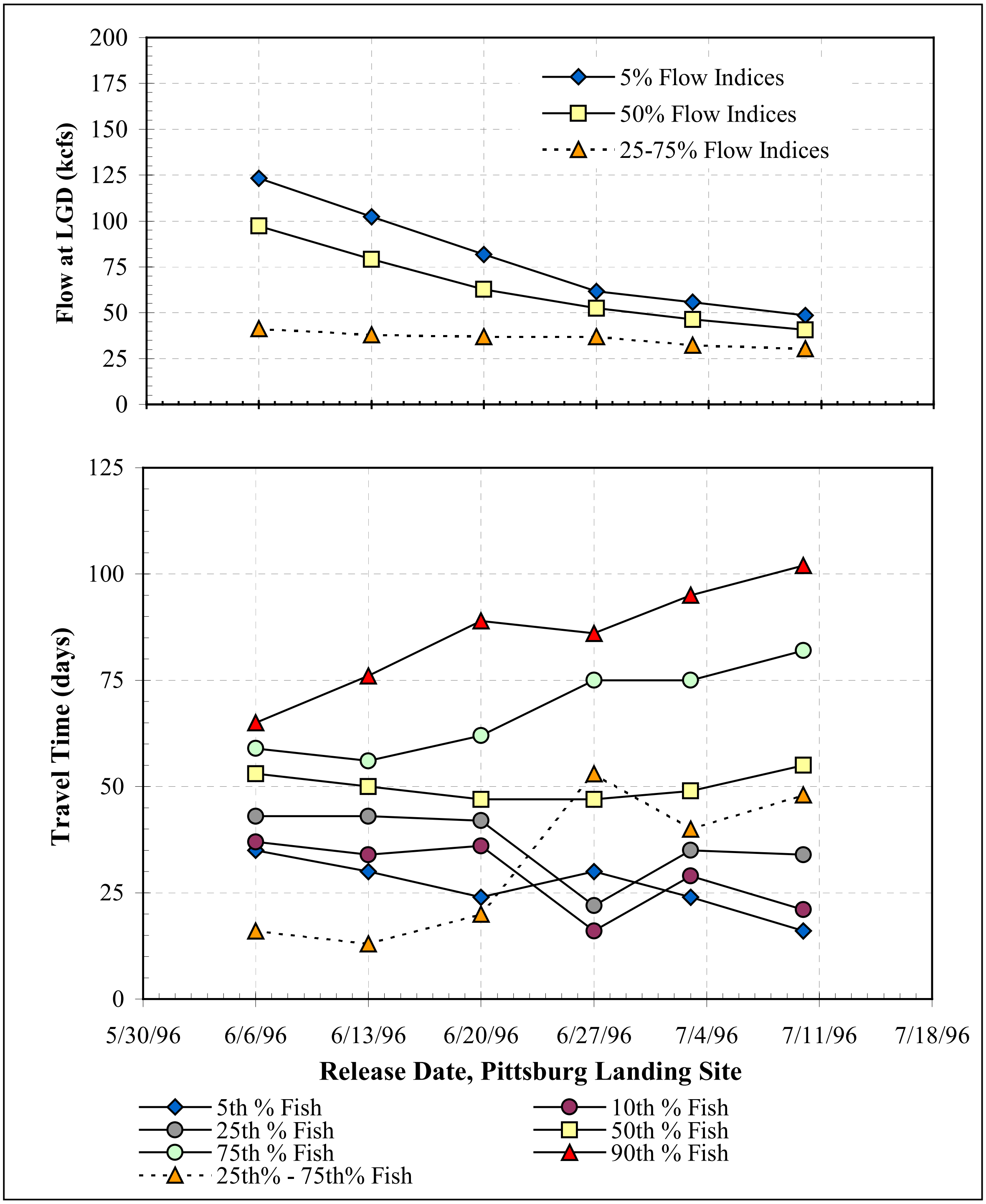

Figure 3.6.3-1: Travel times for the 5th, 10th, 25th, 50th, 75th, 90th, and 25th to 75th percentile surviving fish released from the Pittsburg Landing site in 1996 and corresponding 5th, 50th, and 25th to 75th percentile flow indices at Lower Granite Dam (LGD).

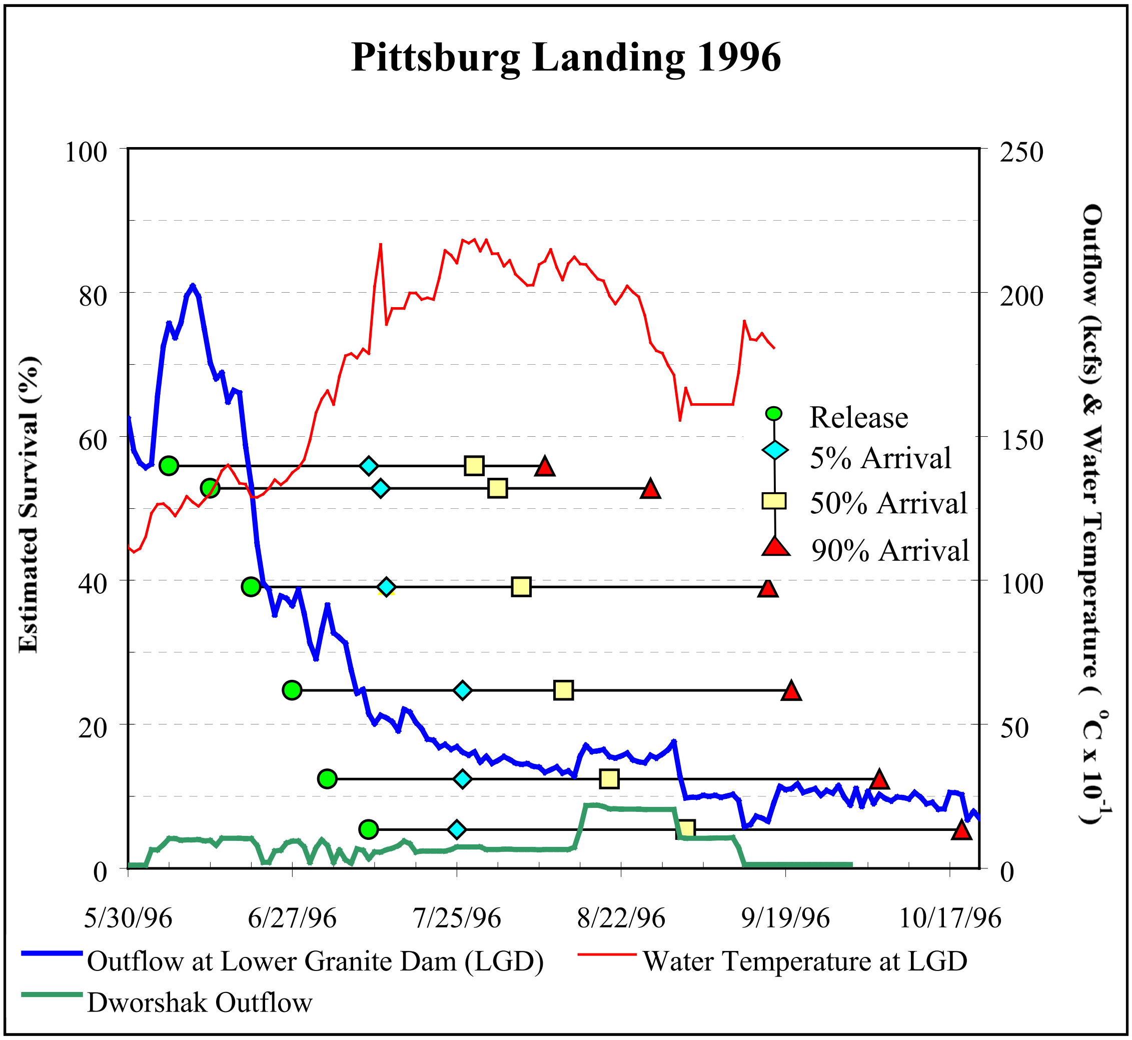

Figure 3.6.3-2: Arrival dates for the 5th, 50th, and 90th percentile surviving fish for the six releases from the Pittsburg Landing site in 1996.

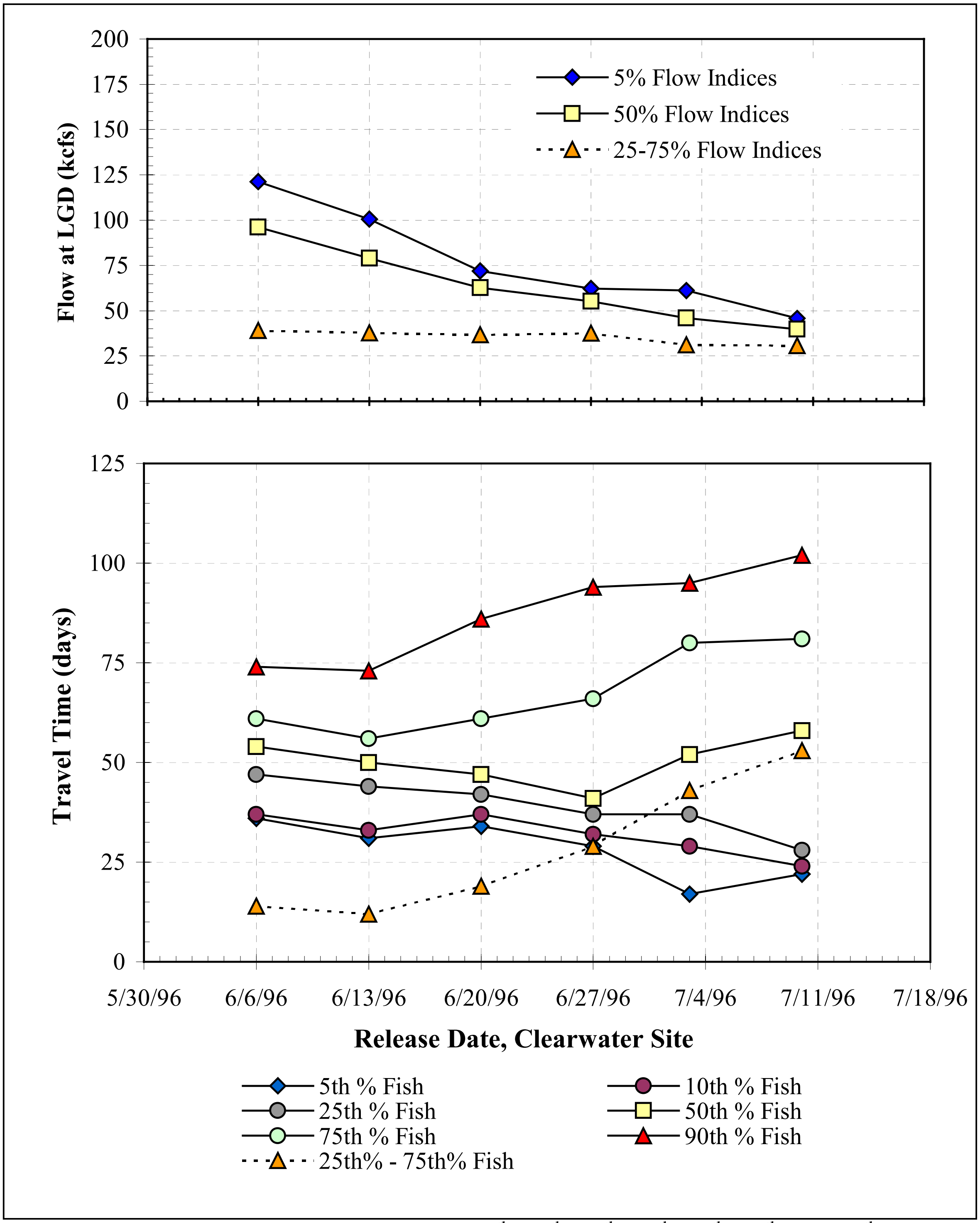

Figure 3.6.3-3: Travel times for the 5th, 10th, 25th, 50th, 75th, 90th, and 25th to 75th percentile fish released from the Clearwater site in 1996 and corresponding 5th, 50th, and 25th through 75th percentile flow indices at Lower Granite Dam (LGD).

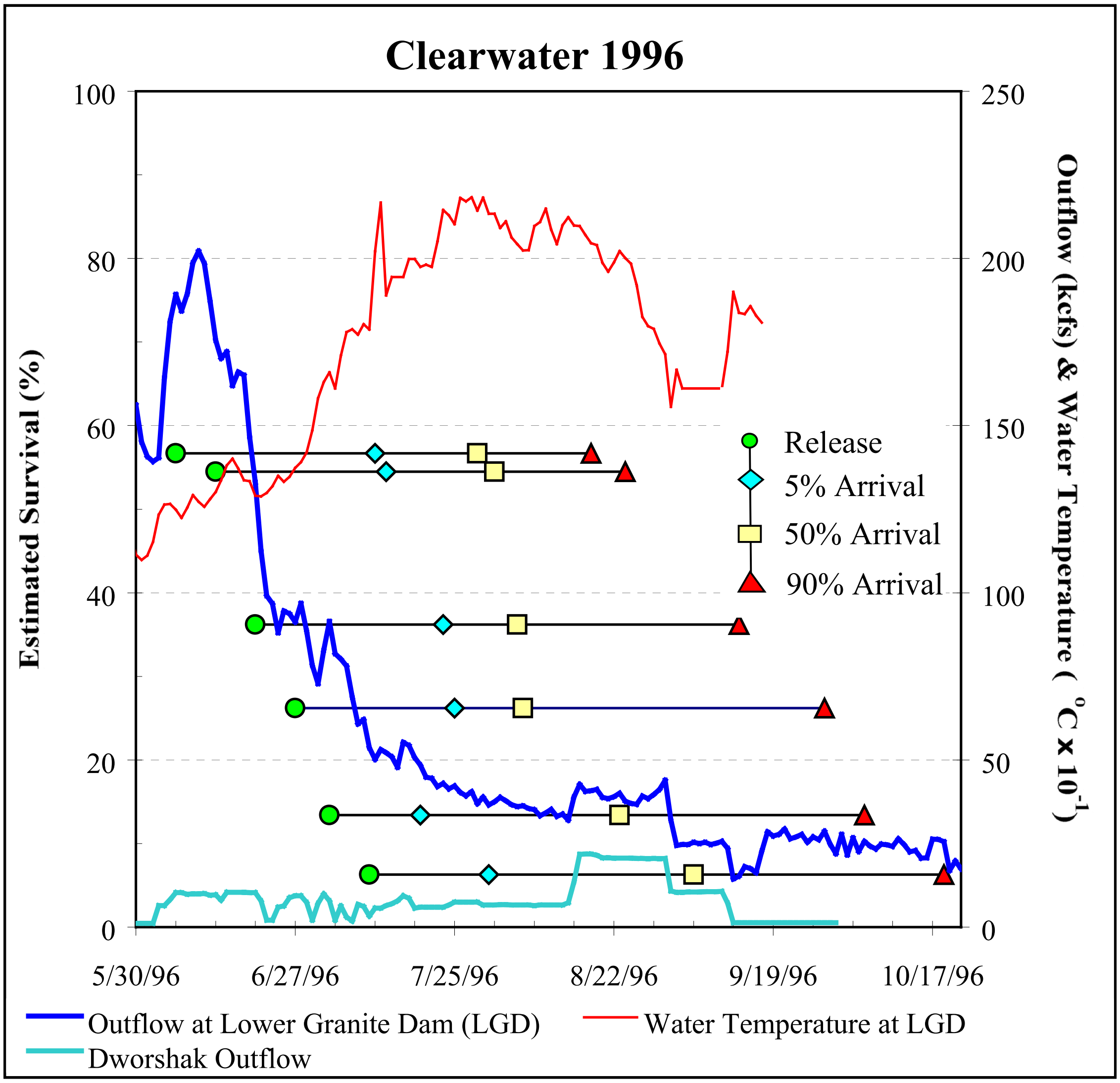

Figure 3.6.3-4: Arrival dates for the 5th, 50th, and 90th percentile surviving fish for the six releases at the Clearwater site in 1996.

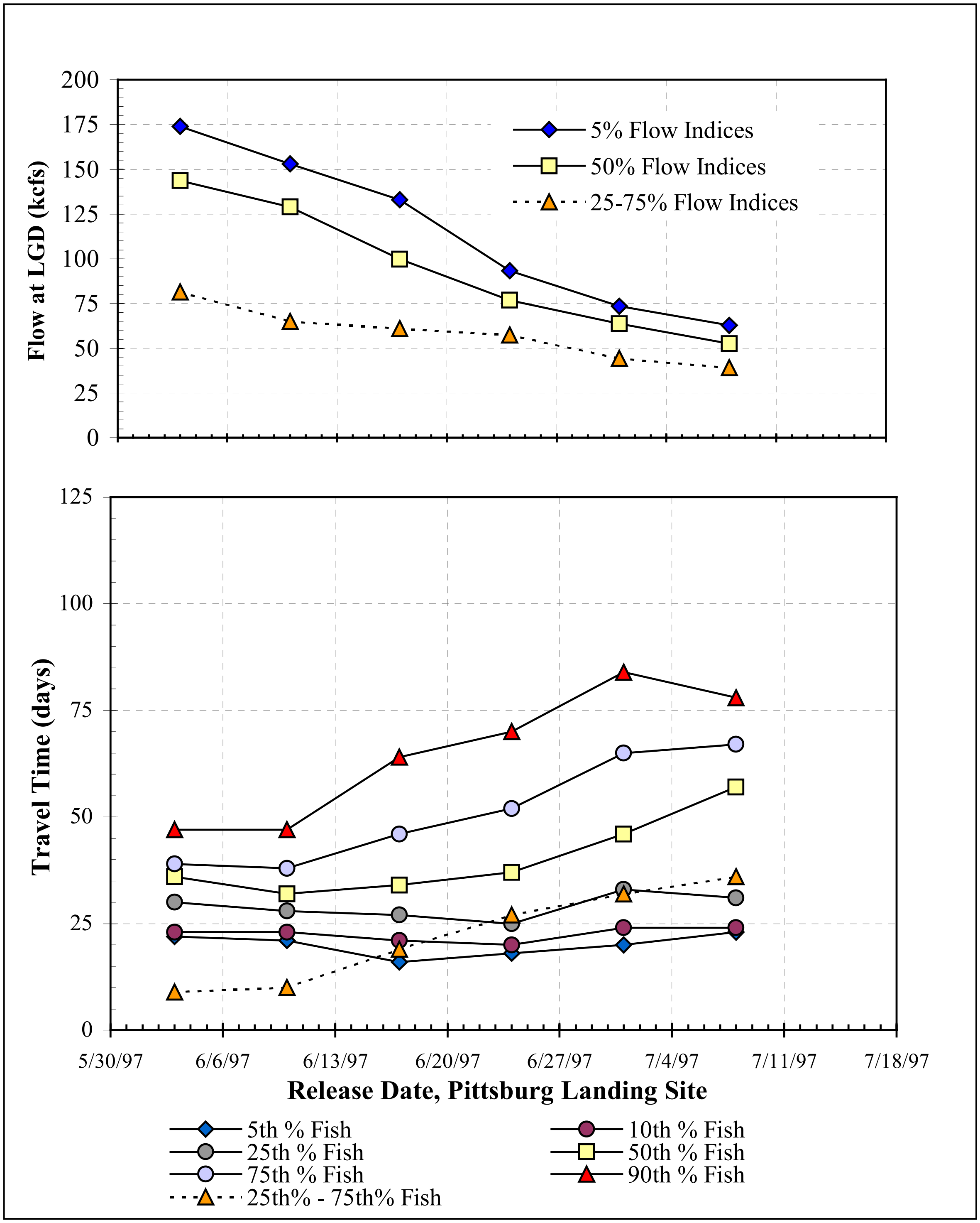

Figure 3.6.3-5: Travel times for the 5th, 10th, 25th, 50th, 75th, 90th, and 25th to 75th percentile surviving fish released from the Pittsburg Landing site in 1997 and corresponding 5th, 50th, and 25th to 75th percentile flow indices at Lower Granite Dam (LGD).

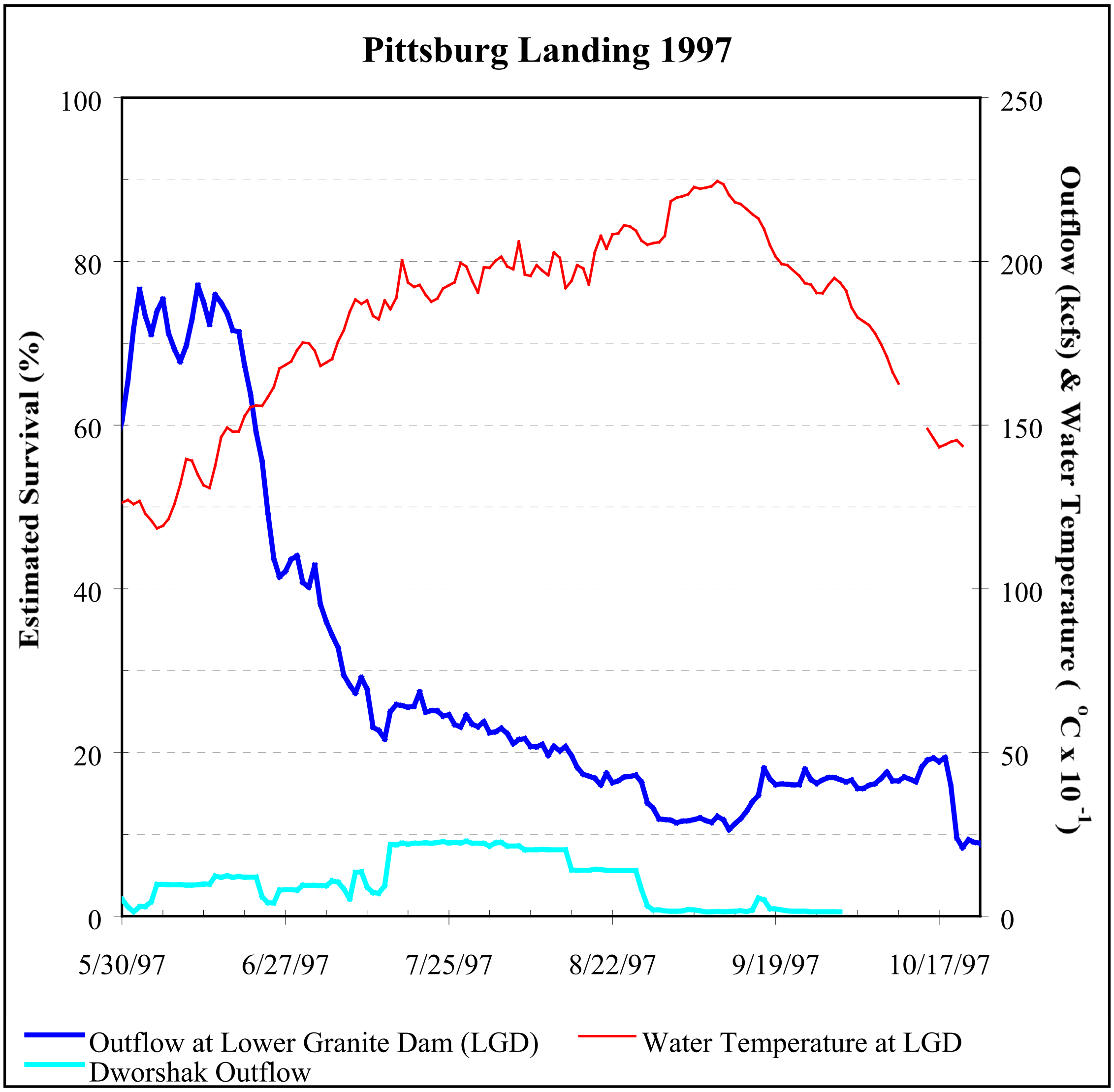

Figure 3.6.3-6: Arrival dates for the 5th, 50th, and 90th percentile surviving fish for the six releases at the Pittsburg Landing site in 1997.

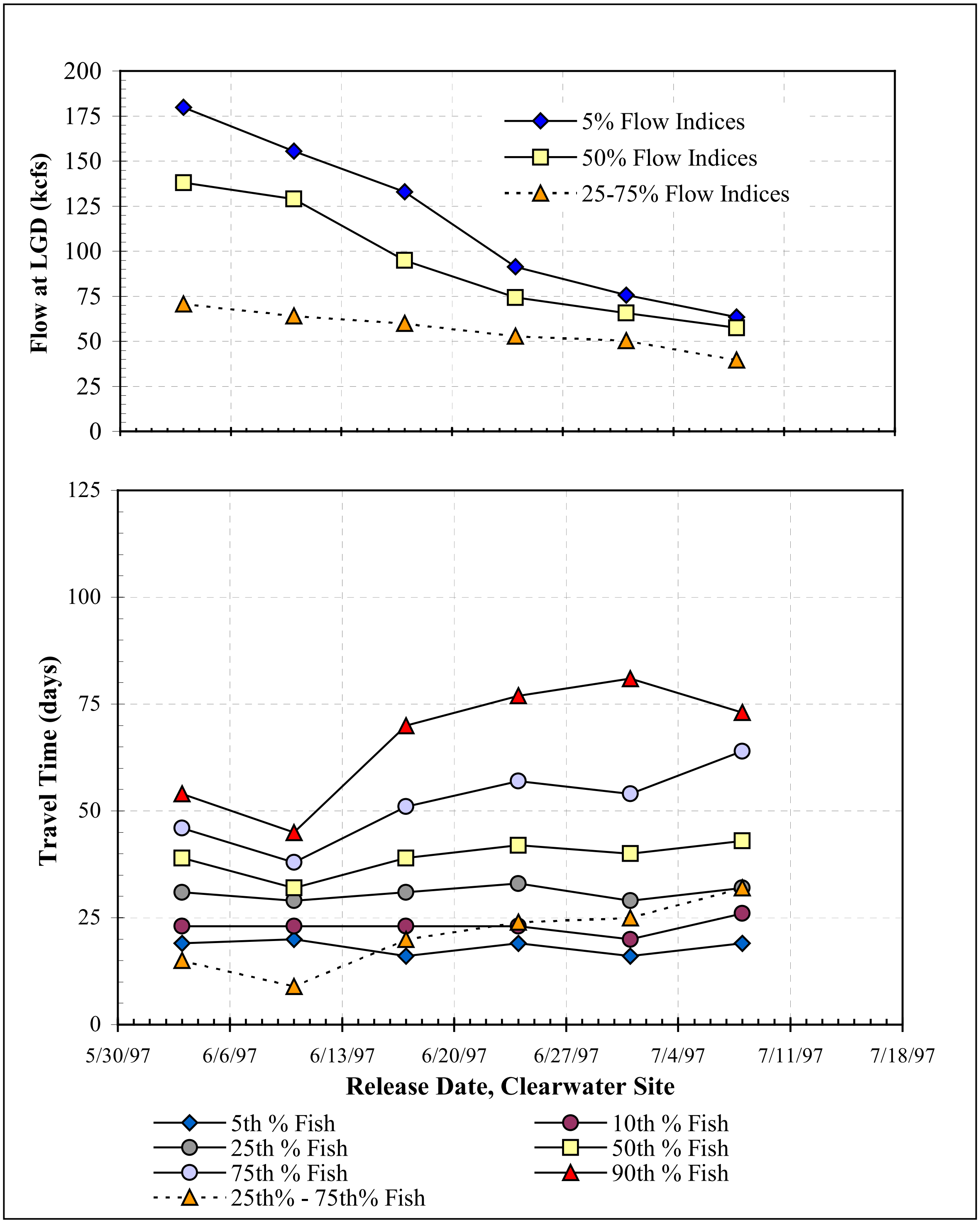

Figure 3.6.3-7: Travel times for the 5th, 10th, 25th, 50th, 75th, 90th, and 25th to 75th percentile surviving fish released from the Clearwater site in 1997 and corresponding 5th, 50th, and 25 through 75th percentile flow indices at Lower Granite Dam (LGD).

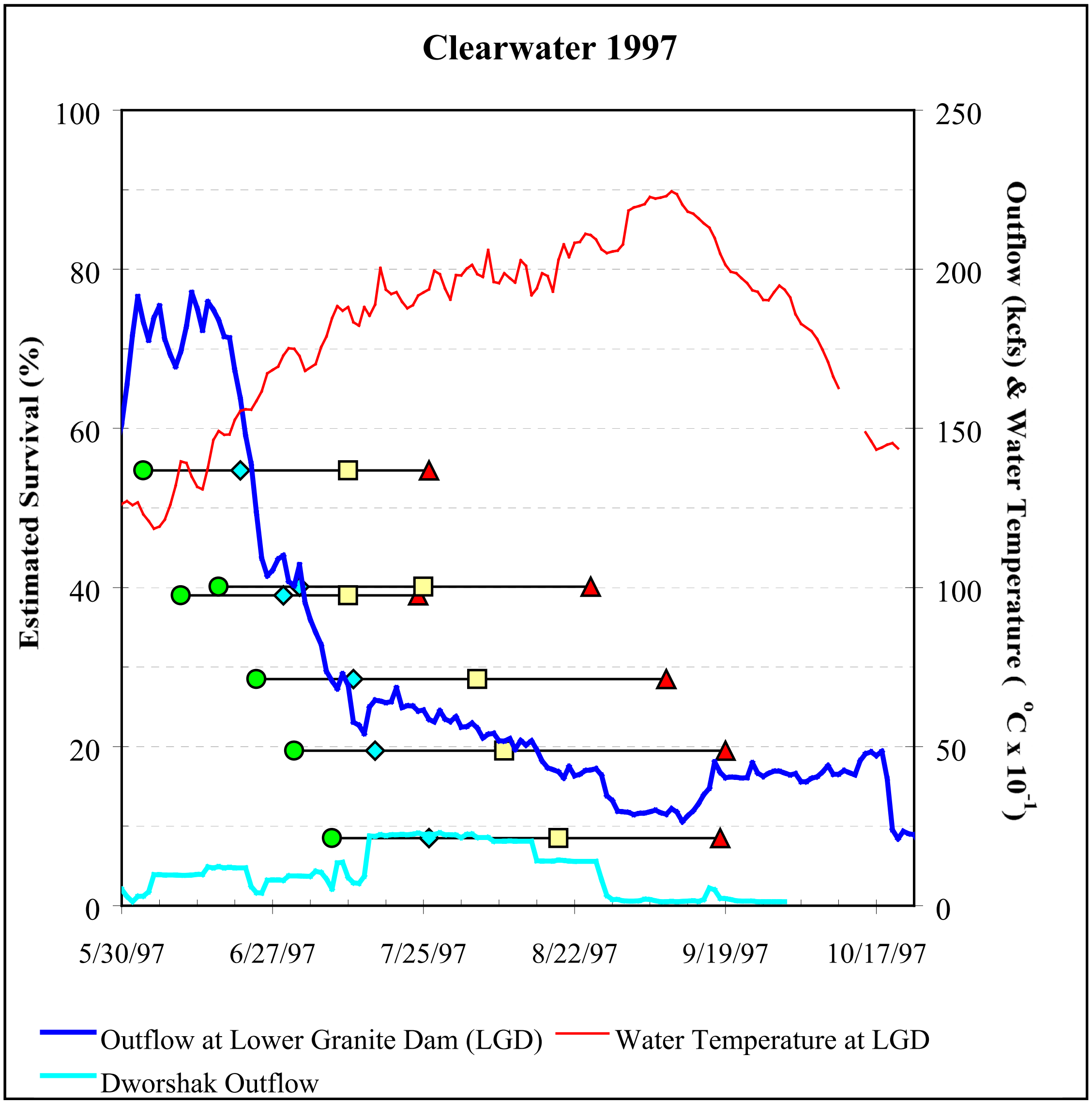

Figure 3.6.3-8: Arrival dates for the 5th, 50th, and 90th percentile surviving fish for the six releases at the Clearwater site in 1997.

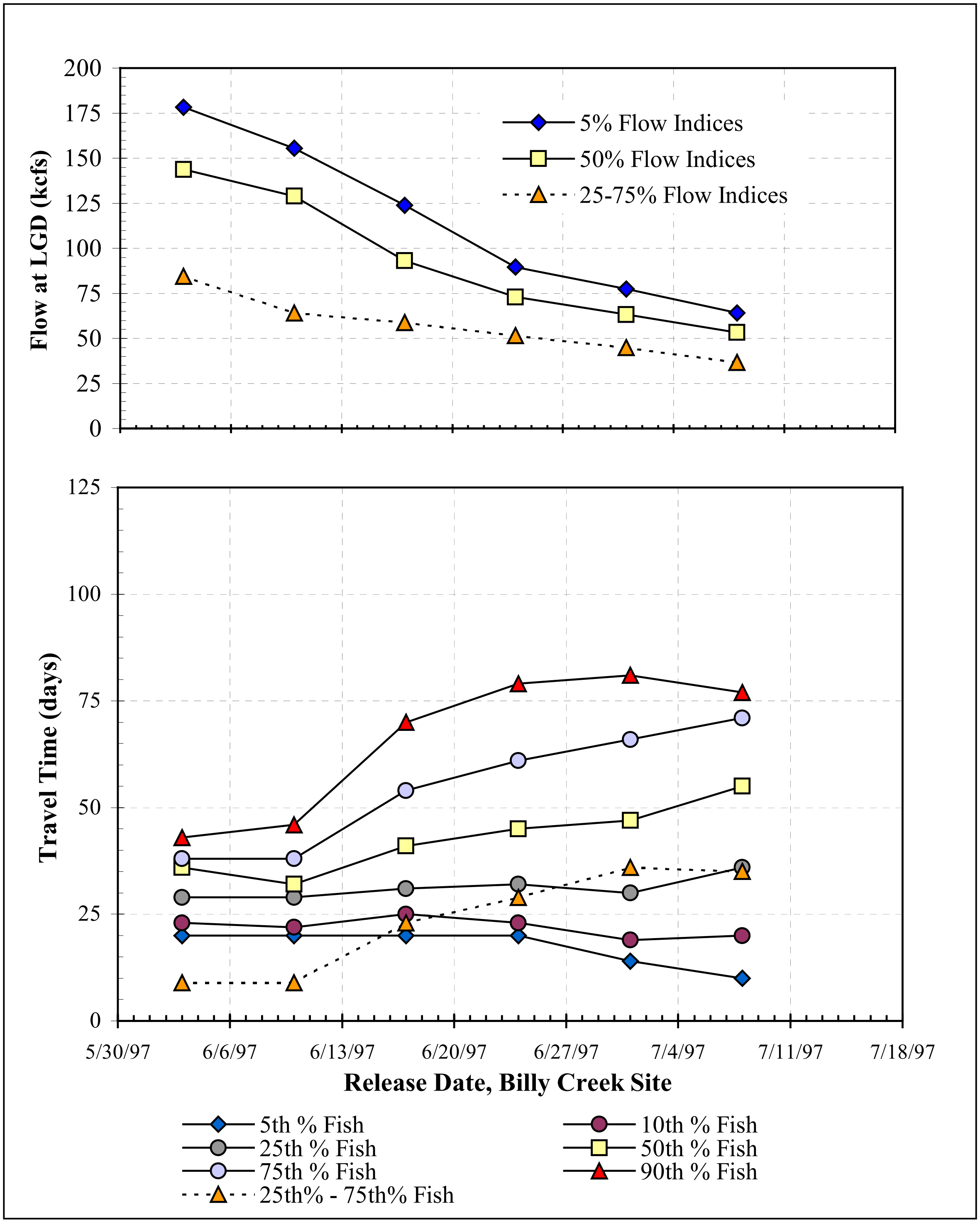

Figure 3.6.3-9: Travel times for the 5th, 10th, 25th, 50th, 75th, 90th, and 25th to 75th percentile surviving fish released from the Billy Creek site in 1997 and corresponding 5th, 50th, and 25th through 75th percentile flow indices at Lower Granite Dam (LGD).

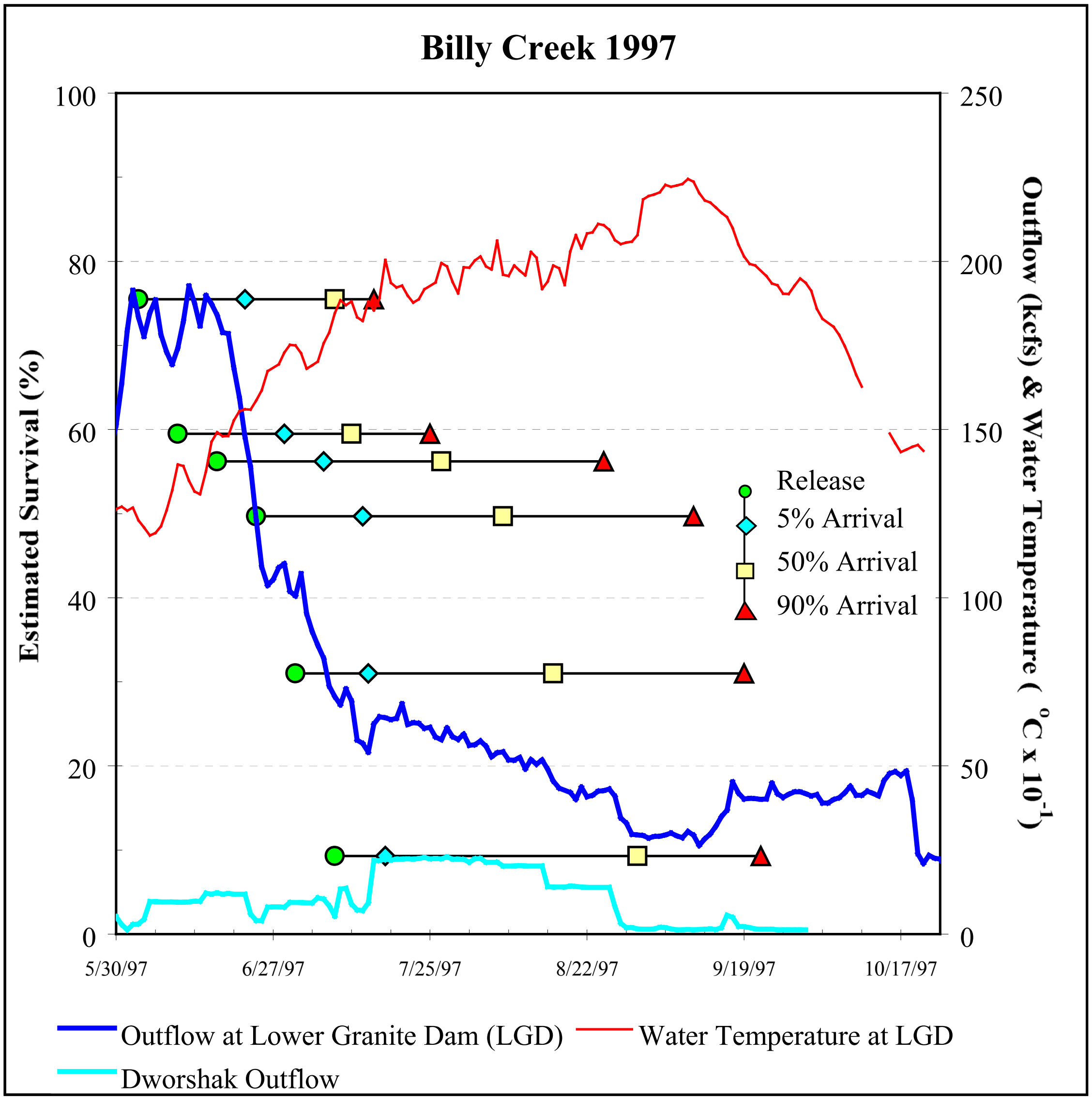

Figure 3.6.3-10: Arrival dates for the 5th, 50th, and 90th percentile surviving fish for the six releases at the Billy Creek site in 1997.

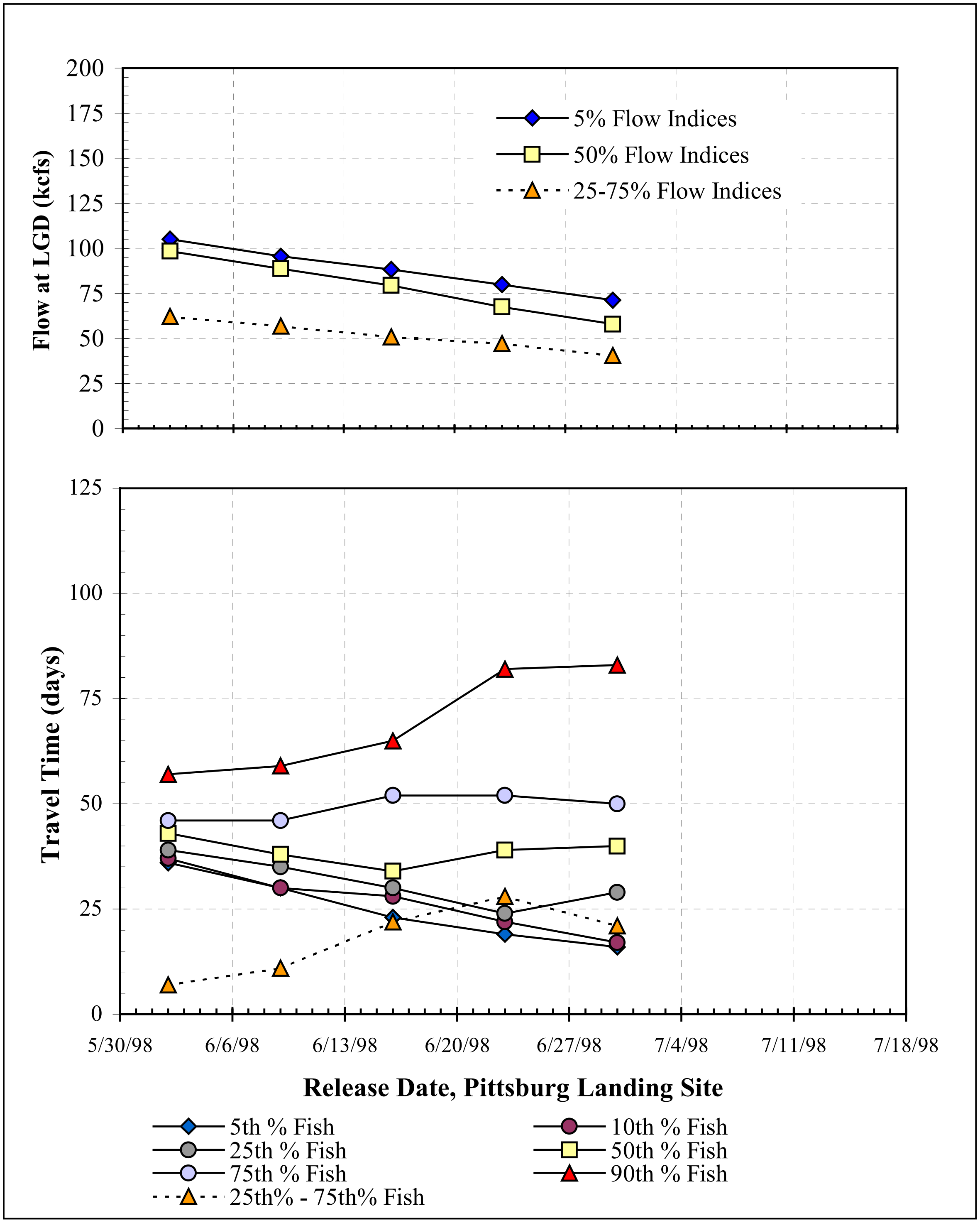

Figure 3.6.3-11: Travel times for the 5th, 10th, 25th, 50th, 75th, 90th, and 25th to 75th percentile surviving fish released from the Pittsburg Landing site in 1998 and corresponding 5th, 50th, and 25th through 75th percentile flow indices at Lower Granite Dam (LGD).

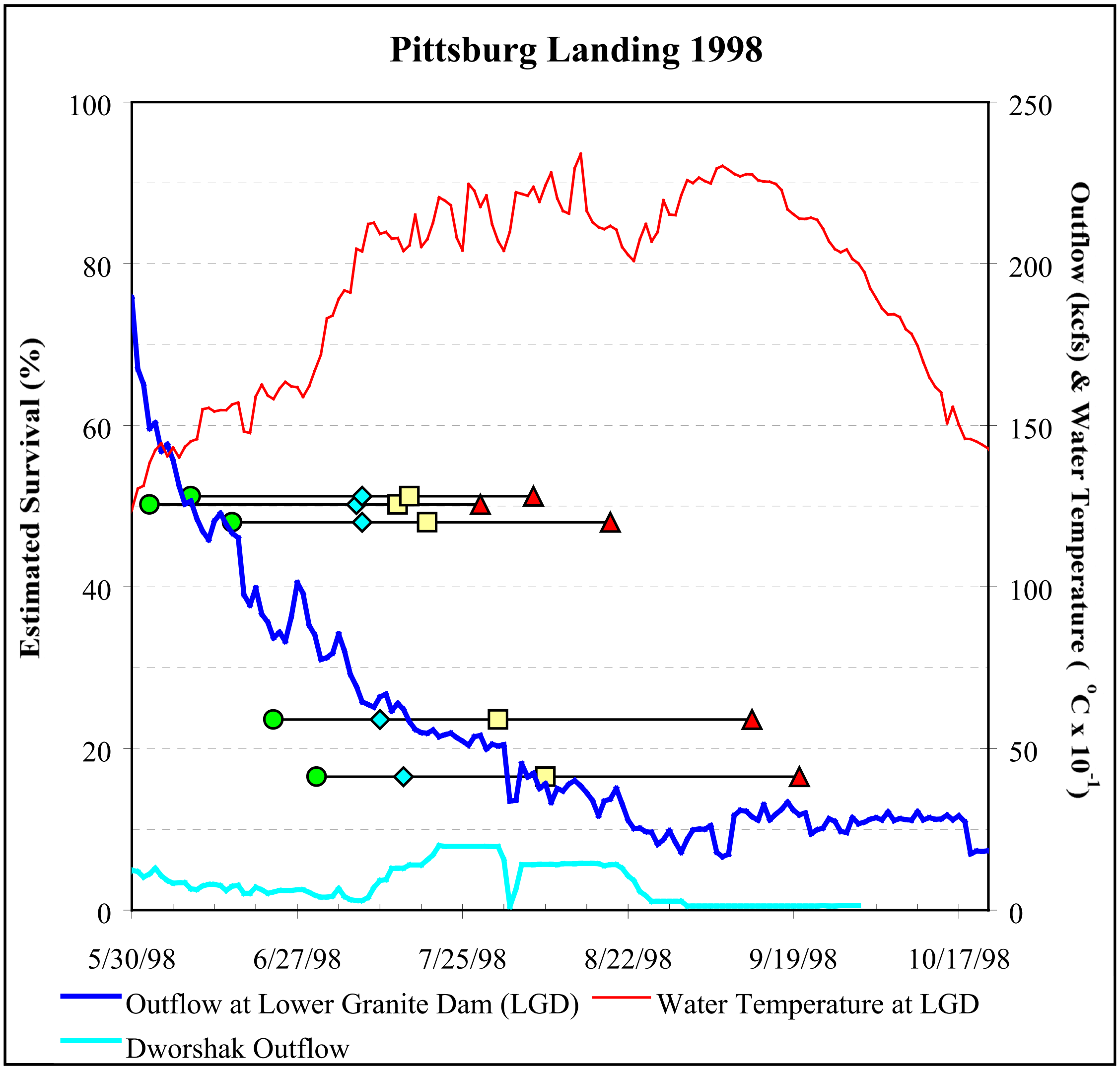

Figure 3.6.3-12: Arrival dates for the 5th, 50th, and 90th percentile surviving fish for the five releases at the Pittsburg Landing site in 1998.

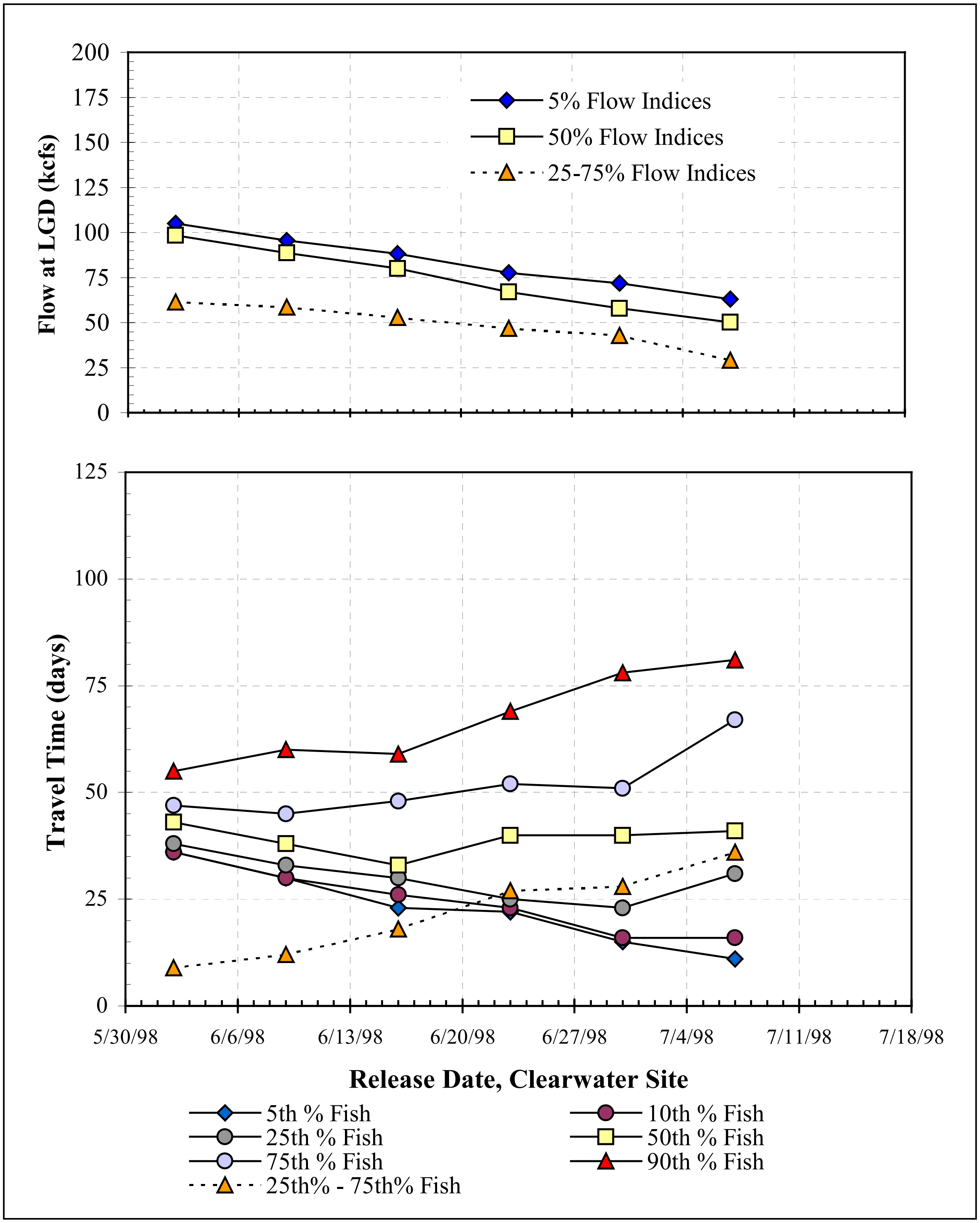

Figure 3.6.3-13: Travel times for the 5th, 10th, 25th, 50th, 75th, 90th, and 25th to 75th percentile fish released from the Clearwater site in 1998 and corresponding 5th, 50th, and 25th through 75th percentile flow indices at Lower Granite Dam (LGD).

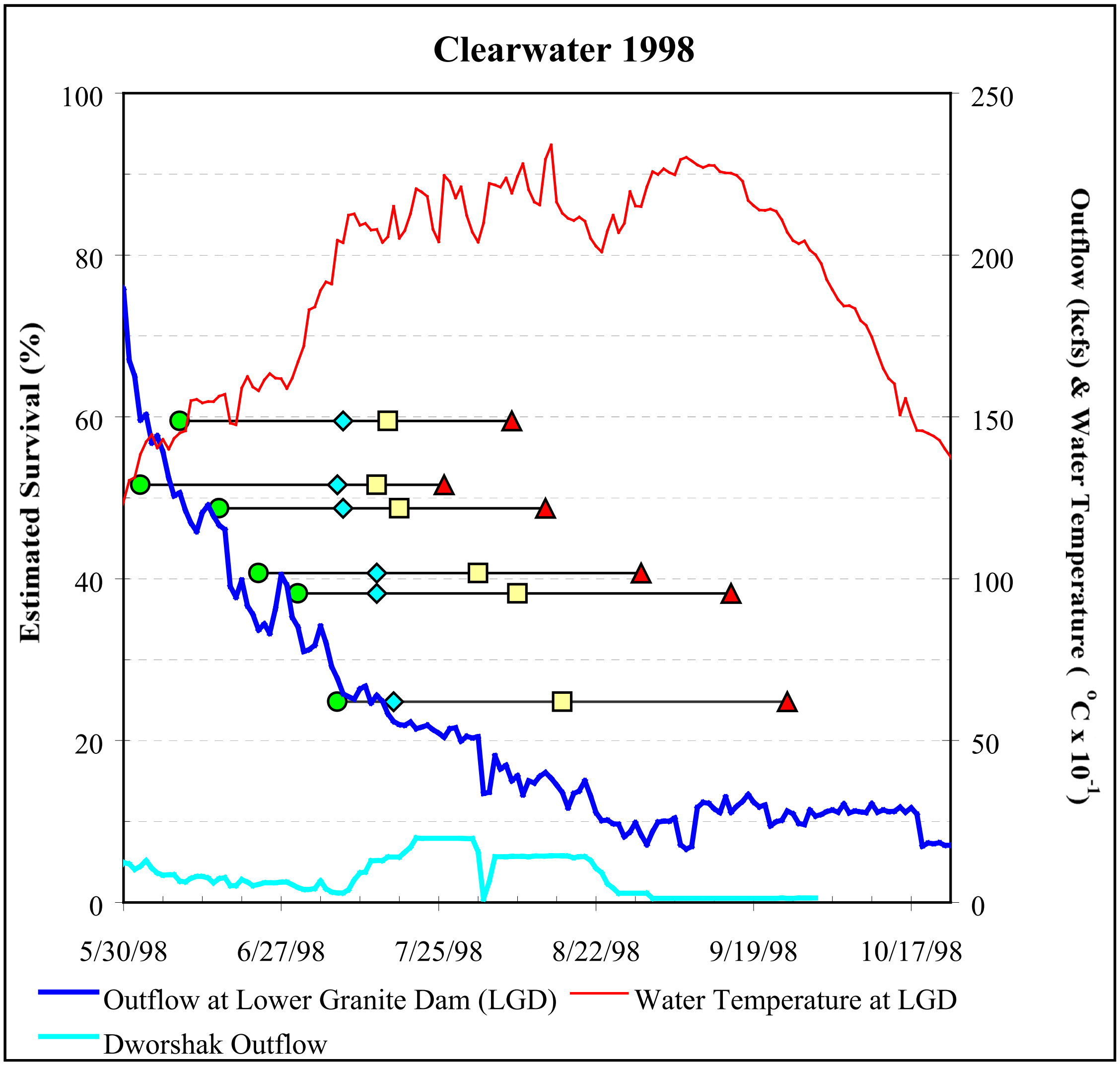

Figure 3.6.3-14: Arrival dates for the 5th, 50th, and 90th percentile surviving fish for the six releases at the Clearwater site in 1998.

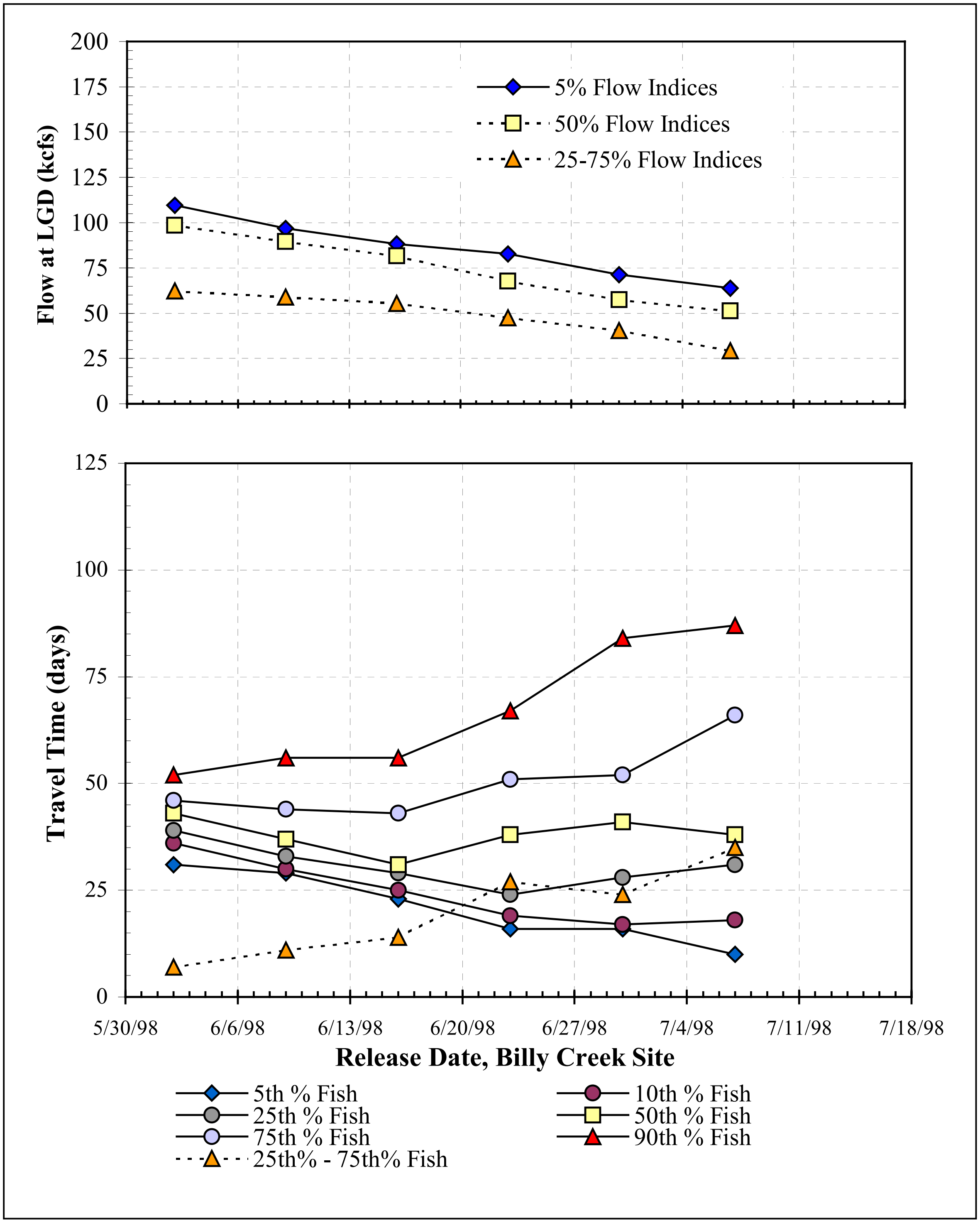

Figure 3.6.3-15: Travel times for the 5th, 10th, 25th, 50th, 75th 90th, and 25th to 75th percentile surviving fish released from the Billy Creek site in 1998 and corresponding 5th, 50th and 25th through 75th percentile flow indices at Lower Granite Dam (LGD).

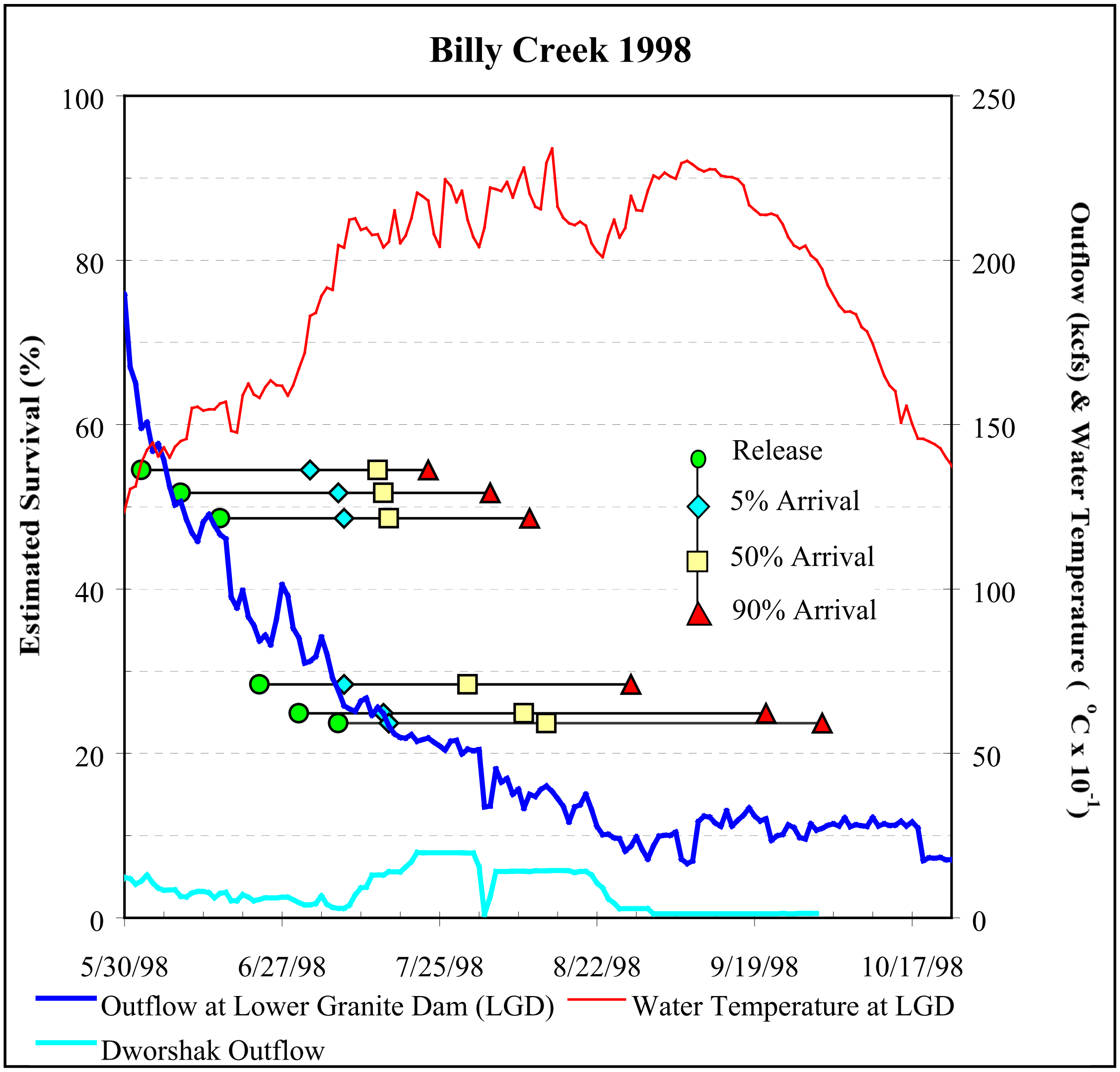

Figure 3.6.3-16: Arrival dates for the 5th, 50th, and 90th percentile surviving fish for the six releases at the Billy Creek site in 1998.

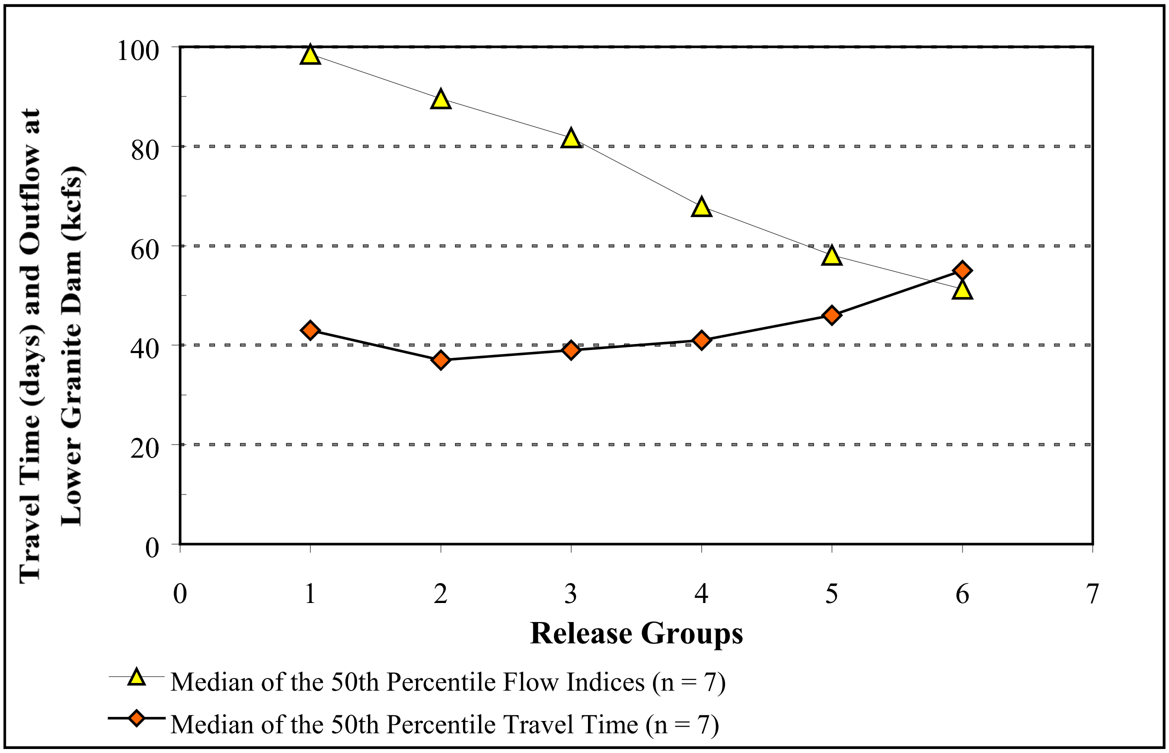

Figure 3.6.3-17: Median travel times for the 50th percentile fish and median outflows for the 50th percentile flow indices by release groups (for all release series with five or more releases), 1995-1998.

Release	1st Releases						6th Releases					
	5% Flow Indices (kcfs)	50% Flow Indices (kcfs)	Travel Time (days)				5% Flow Indices (kcfs)	50% Flow Indices (kcfs)	Travel Time (days)			
			5%	25%	50%	75%			5%	25%	50%	75%
Pittsburgh Landing, 1996	123	97	35	43	53	59	48	41	16	34	55	82
Clearwater, 1996	121	96	36	47	54	61	46	40	22	28	58	81
Pittsburgh Landing, 1997	174	144	22	30	36	39	63	52	23	31	57	67
Billy Creek, 1997	178	144	20	29	36	38	64	53	10	36	55	71
Clearwater, 1997	180	138	19	31	39	46	63	57	19	32	43	64
Pittsburgh Landing, 1998 *	105	99	36	39	43	46						
Billy Creek, 1998	110	99	31	39	43	46	64	51	10	31	38	66
Clearwater, 1998	105	99	36	38	43	47	63	50	11	31	41	67
Average:	137	114	29	37	43	48	59	49	16	32	50	71
Median:	122	99	33	39	43	46	63	51	16	31	55	67
Maximum:	180	144	36	47	54	61	64	57	23	36	58	82
Minimum:	105	96	19	29	36	38	46	40	10	28	38	64
n:	8	8	8	8	8	8	7	7	7	7	7	7

* There was no 6th release from the Pittsburg Landing site in 1998.

Table 3.6.3-1: Travel times (days) for the 5th, 25th, 50th and 75th percentile surviving fish from the 1st and 6th releases at the Pittsburgh Landing , Clearwater , and Billy Creek sites in 1996 through 1998 and the 5th and 50th percentile flow indices based on average daily flows at Lower Granite Dam.

4. DISCUSSION

Various data distributions and comparisons were described in the preceding sections regarding estimated survival, flow rates, water temperatures, release and arrival dates, and travel times for hatchery-raised, subyearling fall chinook salmon between points of release and Lower Granite Dam. This section provides a discussion of these data distributions and comparisons in the context of the following topics:

(1) Limitations of flow-survival studies focusing on reservoir reaches;

(2) "Lumped parameter" characteristic of river flow;

(3) High mortality rates for some of the releases;

(4) Validity of linear regression analyses between flow indices and estimated survival;

(5) Use of the 5th percentile flow and temperature indices in comparisons with estimated survival;

(6) Relationship between estimated survival and date of release;

(7) Differences in travel times and clustered arrival dates;

(8) Use of hatchery-raised, fall chinook salmon as substitutes for wild fall chinook;

(9) "Readiness to migrate" characteristics;

(10) Other factors that may influence subyearling fall chinook survival between point of release and Lower Granite Dam; and

(11) Relationship between flow augmentation and survival of hatchery-raised, subyearling fall chinook salmon between points of release and Lower Granite Dam.

4.1. Limitations of Flow-Survival Studies Focusing on Reservoir Reaches

Adult returns are the best, and only complete, way to assess whether increased flow improves fish survival. The reservoir-reach survival studies conducted by NMFS are inadequate to address the primary survival factors hypothesized to be influenced by flow. Studying the survival of subyearlings through reservoir reaches may address some mortality issues, such as increased exposure to predators, but it does not address the cumulative effect of delayed migration, altered timing of ocean entry, and loss of energy reserves. Patterns detected through juvenile survival studies should be characterized within the context of observed adult returns. For example, preliminary information indicates that low in-river survival of late-migrating juvenile fall chinook did not necessarily correspond with low adult returns (B. Sanford, NMFS, personal communication; IDFG unpublished data).

4.2. "Lumped Parameter" Characteristic of Flow

A number of factors may influence survival and travel time of hatchery-raised, subyearling fall chinook salmon during the course of a migration season. Physical factors include time of release, photoperiod, water velocity, temperature, turbidity, and dissolved gas concentrations. There are also biological factors influencing migration such as fish size, health, smoltification, and degree of acclimation to migration conditions. Some of the physical factors are closely related to flow – e.g., average water velocity through Lower Granite Reservoir is closely related to flow at Lower Granite Dam. Other physical factors, such as temperature, dissolved gas concentrations, and turbidity, are indirectly related to flow. Flow rates and other environmental conditions, such as photoperiod or release date, may also influence biological factors. Thus, flow is a "lumped parameter" because flow encompasses several variables that affect salmon migration and survival, and the significance of these variables can not be distinguished by merely evaluating changes in responses under various flow conditions. It is important to understand and quantify the influence of the various individual attributes of flow on salmon survival. The 1995 through 1998 survival and flow data are insufficient to provide for such evaluation.

4.3. High Mortality Rates for Later Releases

Current data do not provide a sufficient basis for concluding that the relatively high mortality occurring after the release of hatchery-raised fish, especially from later releases, is related to flow rate. An inability to transition from a cultured environment to a natural environment may result in high mortality shortly after release. This post-release mortality is incorporated into survival estimates. If it is relatively high, this initial mortality could strongly influence observed survival patterns, even when the cause of mortality can not be shown to be related to flow conditions. For example, water temperature differentials between the hatchery and the rivers were not constant among release groups. The temperature differential was relatively minor for early releases, but more dramatic for later release groups. Although fish were acclimated prior to release, and acute mortality monitored in net pens, the additional thermal stress on later release groups may have contributed to lower observed survival at Lower Granite Dam than for earlier release groups.

4.4. Linear Regression Characteristics

Linear regressions between estimated survival and river flows and temperatures were presented by Muir et al. (1999) as an indication of the relationship between flow and survival. The linearity of this relationship seems questionable.[7] Additionally, the use of flow indices adds uncertainty to the regression calculations because the indices represent average flows and may not reflect flow conditions during which actual migration occurred (see next section).

4.5. Flow and Temperature Indices

Subyearling fall chinook survival data were described as a single survival percentage for a given release (Muir et al, 1999). To compare the single survival number to flow or temperature, a single number must also be used for the flow rate or temperature. The flow rates and water temperatures, however, are changing during the time that the subyearling fall chinook are migrating from points of release to Lower Granite Dam. Consequently, flow and temperature indices were used in the correlations between estimated survival and flow and water temperature (Muir et al, 1999). The flow and temperature indices are single numbers – the average flow and temperature during a certain time period. In this case, NMFS calculated flow indices based on average daily flow rates, or temperatures, from the time of release to the time of detection of the 5th percentile surviving fish at Lower Granite Dam (Muir et al., 1999).

NMFS (2000) stated the rationale for using the 5th percentile flow indices as follows:

> The 5th passage percentile was chosen to increase contrast among the release groups in the indices of exposure, as the protracted residence time above Lower Granite Dam for subyearling chinook salmon released in the Snake and Clearwater Rivers makes use of the middle 50% exposure index inappropriate for analyses of survival and travel time to Lower Granite Dam.

Furthermore, NMFS stated that:

> Nearly all fish within a group experienced environmental conditions up to the 5th passage percentile date. Using a higher percentile resulted in less contrast in flow and temperature indices among groups, and was not representative for many fish within a group since many had already died because mortality was relatively high for these releases…. To calculate exposure indices based on the week-long period

[7] The recent white paper (NMFS, 2000) acknowledges this observation: "Over the entire range of flow exposures in 1997, the relationship between flow and survival appeared to curve, with a shallower slope at higher than at lower flows" (page 37). Between Lower Granite Dam and Lower Monumental Dam, flow and survival data in the year with the widest range of flow exposure (1998) "strongly suggested that the relationship is curved" (page 41).

> of the 25th to 75th passage percentile would ignore the preceding 5 weeks of common exposure period between the time of release and the 25th passage percentile at the bottom of the reach (NMFS, 2000, page 26).

The appropriateness of 5th percentile flow and temperature indices is questionable. Although fish in early release groups experienced higher flows and lower temperatures (corresponding with the time from release to arrival of the 5th percentile surviving fish), many surviving fish experienced different flow rates and water temperatures during their migration to Lower Granite Dam. Previous studies have used 25th to 75th percentiles (e.g., Smith et al., 1998). Researchers associated with the fall chinook study are aware of this concern, and may recalculate more representative flow and temperature indices (B. Muir, NMFS, personal communication).

The use of 5th percentile flow indices accentuates early season high flows (Figure 2-2). However, the longer travel times (Table 3.6.3-1) of fish from early releases compared to the much shorter travel times for fish from later releases suggest that fish in early releases may not be taking advantage of increased channel velocities during higher, early-season flows to migrate downstream (see Section 4.7). If the fish did not take advantage of increased channel velocities during higher, early-season flows to migrate, then use of the 5th percentile flow indices probably is not appropriate for the early releases. Furthermore, the median travel time for the 75th percentile surviving fish from the last releases is 67 days; the 5th percentile median travel time is only 16 days. Therefore, the 5th percentile flow indices represent only 24 percent of the flow conditions experienced by the 75th percentile fish. For these reasons, the use of other flow indices that more fully reflect actual flows during migration probably would be more appropriate for evaluating flow and survival relationships.

4.6. Estimated Survival and Date of Release

There is a strong relationship between estimated survival and date of release. Muir et al. (1999) also noted this relationship. During the 1995 through 1998 time period, survival rates from early season releases were as high as 76 percent; survival rates from later releases were as low as approximately 5 percent. The correlation between estimated survival and release date is stronger (R^2 = 0.79) than the correlation between estimated survival and 5th percentile flow indices (R^2 = 0.49), and between estimated survival and 5th percentile water temperature indices (R^2 = 0.61) using all of the data (1995-1998). The total survival of hatchery-raised, subyearling fall chinook salmon likely would have been much higher if they had all been released during the first week of June.

The NMFS experimental design assumed sequential releases of hatchery-raised fall chinook would not influence survival independent of flow, temperature, and turbidity. The high correlation between time of release and survival makes this assumption questionable.

4.7. Travel Times and Clustered Arrivals

One benefit attributed to flow augmentation is the resulting increase in channel velocities at higher flows (NMFS, 2000):

> Flow directly affects water velocity and indirectly affects water temperature and turbidity. These factors can in turn influence fish travel time and survival.[8]

However, travel times of hatchery-raised, subyearling fall chinook salmon between point of release and Lower Granite Dam did not appear to be substantially influenced by flow rate. Median travel times (travel times for the 50th percentile surviving fish) in 1996 and 1998 were lowest (i.e., faster travel) for fish in the middle (3rd or 4th) releases, despite the occurrence of larger flows that were experienced by fish in the earlier releases. In 1997, there was more of a correlation between median travel times to Lower Granite Dam and flow rates – although the median travel time was lowest for the 2nd release. The faster median travel times to Lower Granite Dam in 1997 were likely the result of high flows "flushing" the fish out of rearing areas (NMFS, 2000):

> Of the four years of study, the lowest survival estimates and longest travel times between Lower Granite and Lower Monumental Dams were observed in 1997…. A possible cause for the anomaly is that high flows in June and early July prematurely flushed subyearling chinook salmon from their rearing areas in free-flowing river stretches, and the fish continued to rear extensively after they passed Lower Granite Dam. Moreover, the longest travel times in 1997 were observed for the earliest groups passing Lower Granite Dam, despite higher flows.

The 5th percentile travel times decreased steadily from the 1st to the 6th releases in all years, despite decreasing flows. In fact, the median 5th percentile travel time decreased from 33 to 16 days between the 1st and 6th releases, despite an approximately 48 percent decrease in 5th percentile flow indices. The 25th percentile travel times decreased in 1996 and 1998 between the 1st and 6th releases, and remained relatively constant in 1997, despite steadily decreasing flows. Median travel times remained relatively constant for most releases, despite decreasing flow rates. Thus, higher velocities associated with higher early-season flows did not appear to influence median subyearling travel times. While the premise of faster travel at higher flows may apply to inert particles, it did not appear to apply to hatchery-raised, subyearling salmon. Factors in addition to, or other than, channel velocities appear to affect migration rate.

NMFS (2000, pg. 29) also recognized this point:

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[9] Actually, flow does not "affect" temperature – although changes in temperature may be coincident with changes in flow.

> Typically, groups released around 13-15 June had the shortest travel times, and groups released earlier or later had longer travel times . . . flow generally decreased throughout the period of subyearling chinook salmon migration … Consequently, relationships between indices of exposure to environmental variables and median travel time from release to Lower Granite Dam were not strong or consistent…

Other researchers have observed a lack of relationship between travel time, or migration rate, and flow. Giorgi et al. (1997) found that fall chinook salmon did not respond to increased flow in impounded portions of the mid-Columbia River. Migration rates "showed no response to flow over a broad range of discharge (1,500–5,000 m^3/s)" (Giorgi et al., 1997).

Finally, some arrivals of surviving fish at Lower Granite Dam were clustered in ways that appear inconsistent with the postulation that flow rates significantly influence fish travel time. In some cases, the same percentile of surviving fish from several different release groups (at the same release site) arrived on nearly the same day despite being released up to 14 days apart. For example, the 5th percentile surviving fish from the first three releases at the Clearwater site arrived at Lower Granite Dam within one day of each other in 1998 (Figure 3.6.3-14). Similarly, the 50th percentile surviving fish from the first three releases at the Billy Creek site arrived within two days of each other in 1998 (Figure 3.6.3-16). Clustered arrivals were observed in all of the release series in 1996 and 1998, and in some of the 1997 releases. Again, factors other than channel velocities appear to have a greater effect on migration patterns and rates for the hatchery-raised, subyearling fall chinook used in this study.

4.8. Use of Hatchery-Raised Salmon as Analogues for Wild Fish

The hatchery-raised, subyearling fall chinook salmon raised at the Lyons Ferry Hatchery between 1995 and 1998 may not be appropriate analogues for wild fish in survival and flow experiments. Hatchery releases begin in early June and end in mid-July. Wild fall chinook migration typically begins in late June and extends into September. Thus, wild subyearlings experience different flow, temperature, and other factors than fish raised at the Lyons Ferry Hatchery. There is also valid concern that hatchery and naturally-produced fish may respond differently to the same environmental cues relating to migration conditions.

4.9. "Readiness to Migrate"

Another variable – that is termed herein as "readiness to migrate" – may have influenced hatchery-raised, fall chinook migration rates and survival. Fish from the early release groups may have been released prior to the time of optimal physiological conditions for migration and, therefore, migrations were delayed. Evidence for this possibility is the delay between dates of release and dates of detections at Lower Granite Dam for early releases as compared to later releases (see Figures 3.6.2-1 through –3). Subyearlings from the later release groups may have been released at the end of, or after, their optimal physiological time for migration, although a few of the fish from late releases appeared to "catch up," as shown by faster travel times, despite lower flow conditions, as compared with earlier releases.

If hatchery-raised fish are used to evaluate the relationship between reach survival and flow rate, then "readiness to migrate" (including, but not limited to, fish size) must be further investigated under controlled studies. One approach that could perhaps be considered for future studies would be to use smolt traps to collect and mark *actively* migrating fish and then evaluate survival across a range of flow and temperature conditions. Data from such studies might be useful in addressing whether or not flow is related to survival for fish at equivalent conditions of "readiness to migrate."

4.10. Other Factors Influencing Survival

Other factors, in addition to those described in the above paragraphs, also may confound existing data and should be addressed in future studies. These include relatively high, post-release mortality that may be unrelated to temperature or flow; hatchery releases that are not temporally representative of the primary migration period for wild fall chinook salmon; the ability of flow augmentation to compensate for the physical realities associated with water velocity in mainstem reservoirs; the ability of reach survival studies to address effects of altered migration timing, bioenergetics, and the transition into the estuary and ocean caused by reduced water velocity in the mainstem; and the ability of reach survival estimates to reflect survival patterns observed for the entire smolt-to-adult life stage. These factors need to be addressed with and without flow augmentation to determine whether flow augmentation, particularly from the Upper Snake River Basin, provides significant survival benefits.

4.11. Flow Augmentation and Salmon Survival

It has been assumed that flow augmentation provides some of the benefits associated with high natural flows, including higher channel velocities that aid downstream migration. However, the impact of achievable levels of flow augmentation on water velocities through the lower Snake River reservoirs is insignificant compared to natural water velocities that occurred in these reaches before impoundments following the construction of the lower Snake River dams (Dreher, 1998). Even at higher augmentation levels, flow augmentation cannot compensate for the fundamental effect that mainstem reservoirs of the Federal Columbia River Power System (FCRPS) in the lower Snake River have on the velocity of flow (Dreher, 1998; IDFG, 1999; State of Idaho, 1999). Although other factors may have influenced the relationship, the analyses presented in this report show that higher, early-season flows did not appear to correspond with reductions in average subyearling travel times, as would be expected if there were incremental travel time benefits associated with increased water velocities.

The relationships between survival of wild fall chinook salmon and flow and temperature can not be accurately inferred using current data estimating survival of hatchery-raised subyearlings, nor can benefits of flow augmentation be accurately inferred from these data. Even though survival of hatchery-raised, subyearling fall chinook can be correlated with flow, the data do not show a good correlation between flow and median travel times of these fish to Lower Granite Dam. Increasing velocity through flow augmentation may not be a significant factor in migration and in improving the survival of hatchery-raised fish.

Discharges from Dworshak Reservoir, which provide the largest contribution to augmented flows in the lower Snake River, are shown in Figures 3.6.3-2, -4, -6, -8, -10, -12, -14, and –16. In 1996 the majority of surviving fish from the early releases (the releases with the highest estimated survival rates) had already passed Lower Granite Dam by the time flow releases from Dworshak Reservoir began. Flow augmentation from Dworshak began earlier in 1997 and 1998, but fish from the later releases still experienced very low survival rates.

Flow augmentation from Dworshak Reservoir increased flow and decreased water temperatures experienced by a portion of the surviving fish from later releases. Nonetheless, survival of hatchery-raised fish from the later releases continued to decline relative to earlier releases, despite flow augmentation with cooler water from Dworshak Reservoir. If there was improved survival because of temperature reductions associated with flow augmentation from Dworshak releases, the survival improvements may be reduced by simultaneously augmenting flows using warmer water from the Snake River. There currently are no sources of consistently cooler water for augmenting lower Snake River flows other than Dworshak Reservoir.

The existing survival, flow, and temperature data should not be used to conclude that flow augmentation improves survival of outmigrating, subyearling fall chinook salmon in the Snake River above or below Lower Granite Dam. To determine whether there are survival benefits attributable to flow augmentation, future studies must analyze augmentation flows within the context of the specific attributes of flow that are important to fish, i.e., water velocity, temperature, and turbidity. The analyses must delineate the extent that flow augmentation improves water velocity, temperature, and turbidity in the lower Snake River, and the extent (if any) that these improvements increase survival. Future evaluations of subyearling fall chinook survival as related to flow augmentation must also include analysis of other factors, such as “readiness-to-migrate” maturation.

In summary, the importance of flow on the survival of hatchery-raised, subyearling fall chinook between points of release and Lower Granite Dam and the survival benefits (if any) from flow augmentation cannot be determined from the NMFS data and analyses reviewed in this report. The correlation between flow and estimated survival does not imply cause and effect. Other factors, such as date of release and "readiness-to-migrate," may have greater impacts than flow on outmigration and survival of hatchery-raised, subyearling fall chinook salmon. Obviously water velocity, temperature, and turbidity are important to migrating fish. However, the existing correlations between hatchery-raised, subyearling fall chinook survival and flow rates do not support or refute the assumption that augmenting mainstem Snake River flows improves subyearling survival.

5. CONCLUSIONS

Data describing the estimated survival of hatchery-raised, subyearling fall chinook salmon from release to Lower Granite Dam have been correlated with flows in the lower Snake River (Muir et al., 1999). These correlations have been used to justify flow augmentation in the lower Snake River. The principal conclusion of the review of survival data and flow rates presented in this report is that the existing data, despite showing an apparent correlation between flow and survival, do not imply a cause and effect relationship between flow and survival of subyearlings and should not be used as a basis to justify flow augmentation. This is primarily because the experimental design did not address other factors that appear to have strongly influenced migration characteristics and survival. This conclusion is not inconsistent with a conclusion reached recently by NMFS (2000):

> Because environmental variables were highly correlated with each other, determining which variable was most important to subyearling fall chinook salmon survival was not possible.

The following observations support this principal conclusion:

1. The survival of subyearling fall chinook appears to be dependent on multiple factors, and the NMFS study did not separate the effects on survival of individual attributes of flow (i.e., velocity, turbidity, and temperature). Furthermore, the experimental design and resulting data are insufficient to imply that velocity improvements associated with flow augmentation increase survival.

2. There is a strong correlation between estimated survival and date of release. Survival rates from early releases (late May or early June) were as high as 76 percent. Estimated survival decreased with each successive release. Survival rates from final releases (e.g., second week of July) were as low as approximately 5 percent. The high correlation between date of release and survival brings into question the inherent assumption that sequential releases of hatchery-raised, fall chinook would not influence survival independent of flow, temperature, and turbidity.

3. Muir et al. (1999) reported a positive correlation between subyearling survival and the 5^{th} percentile flow indices, and a negative correlation between subyearling survival and the 5^{th} percentile water temperature indices. However, these analyses raise at least three concerns. First, the correlations do not imply cause and effect relationships. Second, the flow and temperature indices were not representative of overall migration conditions experienced by most of the fish in the various release groups. Third, the correlations may be strongly influenced by other factors such as "readiness to migrate" and date of release.

4. Migration of hatchery-raised, subyearling fall chinook from early releases appeared to be delayed. The travel times for the 5^{th}, 10^{th}, and 25^{th} percentile surviving fish were consistently greater (longer) for the early releases than for the late releases, despite the occurrence of higher flows and lower temperatures experienced by fish in early releases.

5. There was no significant difference between the median travel times of 50^{th} percentile surviving fish for the six weekly release groups at the 95 percent confidence level, even though the median values for the 50^{th} percentile flow indices decreased from 99 kcfs (1^{st} release) to 51 kcfs (6^{th} release). This implies that factors other than, or in addition to, flow substantially affect outmigrating fall chinook.

6. Clustered arrival times for the same percentiles of surviving fish from different releases also suggest that outmigration is influenced by factors other than flow.

7. "Readiness to migrate" may be a significant factor influencing the outmigration of hatchery-raised, subyearling fall chinook. However, this variable and its relationship to survival and flows cannot be evaluated with current data.

In summary, until the specific factors influencing survival are better understood, the flow and survival data reviewed in this report should not be used as a basis to justify flow augmentation.

6. REFERENCES

Dreher, K.J. 1998. A view on Idaho's experience with flow augmentation. Idaho Department of Water Resources, Boise, Idaho, 16 pp.

Giorgi, A. E., T. W. Hillman, J. R. Stevenson, S. G. Hays, and C. M. Peven. 1997. Factors that influence the downstream migration rates of juvenile salmon and steelhead through the hydroelectric system in the Mid-Columbia River basin. North American Journal of Fisheries Management, 17:268-282.

Hockersmith, E. E., S. G. Smith, W. E. Muir, B. P. Sandford, J. G. Williams, and J. R. Skalski. 1999. Survival estimates for the passage of juvenile salmonids through Snake River dams and reservoirs, 1997. Annual report (DOE/BP-10891-7) to Bonneville Power Administration, Portland, OR.

IDFG (Idaho Department of Fish and Game). 1999. Review of NMFS draft white papers. Idaho Department of Fish and Game, Boise, Idaho, 94 pp.

Muir, W. D., S. G. Smith, E. E. Hockersmith, M. B. Eppard, W. P. Connor, T. Anderson, and B. D. Arnsberg. 1999. Fall chinook salmon survival and supplementation studies in the Snake River and Lower Snake River Reservoirs, 1997. Annual Report (DOE/BP-10891-8) to the Bonneville Power Administration, Portland, OR.

NMFS. 1999. Salmonid travel time and survival related to flow management in the Columbia River Basin. Draft White Paper, National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington, 56 pp.

NMFS. 2000. Salmonid travel time and survival related to flow management in the Columbia River Basin. White Paper, National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington, 58 pp.

Smith, S. G., W. D. Muir, E. E. Hockersmith, M. B. Eppard, and W. P. Connor. 1998a. Passage survival of natural and hatchery subyearling fall chinook salmon to Lower Granite, Little Goose, and Lower Monumental Dams. *In* J. G. Williams and T. C. Bjornn (editors), Fall chinook salmon survival and supplementation studies in the Snake and Lower Columbia River Reservoirs, 1995, p. 1-65. Report to the Bonneville Power Administration, Contract 93AI10891 and the U. S. Army Corps of Engineers, Contract E86950141.

Smith, S. G., W. D. Muir, E. E. Hockersmith, S. Achord, M. B., Eppard, T. E. Ruehle, and J. G. Williams. 1998b. Survival estimates for the passage of juvenile salmonids through Snake River Dams and Reservoirs, 1996. Prepared for the U. S. Department of Energy, Bonneville Power Administration, Portland, OR, Contract Number DE-AI79-93BP10891.

State of Idaho. 1999. State of Idaho comments on the draft biological opinion – Bureau of Reclamation operations and maintenance projects in the Snake River Basin above Lower Granite Dam: a supplement to the biological opinions signed on March 2, 1995, and May 14, 1998. Office of the Governor, Statehouse, Boise, Idaho, 22 pp. plus Appendices.

Appendix A. NMFS Fall Chinook Data at Lower Granite Dam, 1995-1998.

Release Site & Release Sequence	Release Date	Survival (%)	Arrival Date of 5th % Fish	Days to 5th % Arrival	Average Outflow (kcfs) for 5th % indices	Averge Temperature (C) for 5th % indices	Arrival Date of 10th % Fish	Days to 10th % Arrival	Average Outflow (kcfs) for the 10th % indices	Average Temperature (C) for the 10th % indices
PL95_1	5/31/95	65.6	7/4/95	35	111.35	15.16	7/11/95	42	104.75	15.74
PL95_2	6/7/95	64.8	7/11/95	35	98.33	15.97	7/19/95	43	91.00	16.85
PL95_3	6/14/95	59.6	7/20/95	37	84.56	17.64	7/24/95	41	80.94	18.00
BC95_1	6/1/95	64.4	7/7/95	37	108.15	15.37	7/12/95	42	103.48	15.86
BC95_2	6/8/95	59.4	7/9/95	32	99.01	15.84	7/16/95	39	92.80	16.59
BC95_3	6/15/95	59.4	7/15/95	31	88.59	17.09	7/20/95	36	83.59	17.70
AS95_1	6/19/95	49.9	7/11/95	23	87.61	16.94	7/24/95	36	75.73	18.38
AS95_2	6/27/95	46	7/26/95	30	67.48	19.54	8/2/95	37	63.70	19.77
AS95_3	7/5/95	38.8	8/3/95	30	56.36	20.33	8/7/95	34	54.82	20.37
PL96_1	6/6/96	55.9	7/10/96	35	123.20	14.37	7/12/96	37	119.34	14.73
PL96_2	6/13/96	52.8	7/12/96	30	102.19	15.22	7/16/96	34	96.24	15.70
PL96_3	6/20/96	39.1	7/13/96	24	81.69	15.87	7/25/96	36	70.17	17.30
PL96_4	6/27/96	24.7	7/26/96	30	61.62	18.41	7/12/96	16	74.42	16.86
PL96_5	7/3/96	12.4	7/26/96	24	55.76	19.31	7/31/96	29	52.77	19.71
PL96_6	7/10/96	5.4	7/25/96	16	48.42	20.03	7/30/96	21	46.22	20.43
PD96_1	6/13/96	57.1	7/12/96	30	102.19	15.22	7/15/96	33	97.48	15.59
PD96_2	6/20/96	53.8	7/19/96	30	75.60	16.63	7/25/96	36	70.17	17.30
CW96_1	6/6/96	56.7	7/11/96	36	121.18	14.54	7/12/96	37	119.34	14.73
CW96_2	6/13/96	54.5	7/13/96	31	100.58	15.34	7/15/96	33	97.48	15.59
CW96_3	6/20/96	36.2	7/23/96	34	71.84	17.07	7/26/96	37	69.36	17.42
CW96_4	6/27/96	26.2	7/25/96	29	62.36	18.29	7/28/96	32	60.27	18.62
CW96_5	7/3/96	13.4	7/19/96	17	61.17	18.70	7/31/96	29	52.77	19.71
CW96_6	7/10/96	6.3	7/31/96	22	45.78	20.47	8/2/96	24	45.14	20.53
PL97_1	6/3/97	57.3	6/24/97	22	174.04	13.84	6/25/97	23	171.22	13.94
PL97_2	6/10/97	62.2	6/30/97	21	153.00	15.23	7/2/97	23	148.73	15.42
PL97_3	6/17/97	58.2	7/2/97	16	132.89	16.17	7/7/97	21	121.58	16.42
PL97_4	6/24/97	48.8	7/11/97	18	93.23	17.40	7/13/97	20	89.63	17.48
PL97_5	7/1/97	23.7	7/20/97	20	73.59	18.32	7/24/97	24	71.70	18.43

Appendix A. NMFS Fall Chinook Data at Lower Granite Dam, 1995-1998.

Release Site & Release Sequence	Release Date	Survival (%)	Arrival Date of 5th % Fish	Days to 5th % Arrival	Average Outflow (kcfs) for 5th % indices	Averge Temperature (C) for 5th % indices	Arrival Date of 10th % Fish	Days to 10th % Arrival	Average Outflow (kcfs) for the 10th % indices	Average Temperature (C) for the 10th % indices
PL97_6	7/8/97	13.7	7/30/97	23	62.70	19.05	7/31/97	24	62.56	19.08
PD97_1	5/28/97	67.6	6/19/97	23	176.64	13.10	6/21/97	25	175.62	13.29
PD97_2	5/30/97	65.2	6/20/97	22	179.31	13.29	6/22/97	24	177.18	13.48
BC97_1	6/3/97	75.5	6/22/97	20	178.33	13.65	6/25/97	23	171.22	13.94
BC97_2	6/10/97	59.5	6/29/97	20	155.56	15.12	7/1/97	22	150.62	15.33
BC97_3	6/17/97	56.2	7/6/97	20	123.97	16.35	7/11/97	25	113.36	16.79
BC97_4	6/24/97	49.7	7/13/97	20	89.63	17.48	7/16/97	23	85.81	17.65
BC97_5	7/1/97	31	7/14/97	14	77.43	17.94	7/19/97	19	73.86	18.27
BC97_6	7/8/97	9.3	7/17/97	10	64.09	18.77	7/27/97	20	63.21	19.00
CW97_1	6/3/97	54.7	6/21/97	19	179.93	13.55	6/25/97	23	171.22	13.94
CW97_2	6/10/97	39	6/29/97	20	155.56	15.12	7/2/97	23	148.73	15.42
CW97_3	6/17/97	40.1	7/2/97	16	132.89	16.17	7/9/97	23	117.04	16.61
CW97_4	6/24/97	28.5	7/12/97	19	91.36	17.44	7/16/97	23	85.81	17.65
CW97_5	7/1/97	19.5	7/16/97	16	75.69	18.04	7/20/97	20	73.59	18.32
CW97_6	7/8/97	8.5	7/26/97	19	63.49	18.94	8/2/97	26	62.07	19.15
PL98_1	6/2/98	50.2	7/7/98	36	105.20	15.99	7/8/98	37	104.10	16.11
PL98_2	6/9/98	51.2	7/8/98	30	95.66	16.56	7/8/98	30	95.66	16.56
PL98_3	6/16/98	48	7/8/98	23	88.17	16.97	7/13/98	28	83.88	17.70
PL98_4	6/23/98	23.6	7/11/98	19	79.80	18.15	7/14/98	22	77.66	18.51
PL98_5	6/30/98	16.5	7/15/98	16	71.21	19.69	7/16/98	17	70.45	19.74
PD98_1	6/4/98	76.3	7/7/98	34	102.57	16.10	7/7/98	34	102.57	16.10
PD98_2	6/6/98	65.8	7/7/98	32	100.04	16.22	7/7/98	32	100.04	16.22
BC98_1	6/2/98	54.5	7/2/98	31	109.67	15.47	7/7/98	36	105.20	15.99
BC98_2	6/9/98	51.7	7/7/98	29	96.73	16.43	7/8/98	30	95.66	16.56
BC98_3	6/16/98	48.6	7/8/98	23	88.17	16.97	7/10/98	25	86.17	17.31
BC98_4	6/23/98	28.4	7/8/98	16	82.74	17.59	7/11/98	19	79.80	18.15
BC98_5	6/30/98	24.9	7/15/98	16	71.21	19.69	7/16/98	17	70.45	19.74
BC98_6	7/7/98	23.7	7/16/98	10	63.88	20.78	7/24/98	18	59.78	21.02

Appendix A. NMFS Fall Chinook Data at Lower Granite Dam, 1995-1998.

Release Site & Release Sequence	Release Date	Survival (%)	Arrival Date of 5th % Fish	Days to 5th % Arrival	Average Outflow (kcfs) for 5th % indices	Averge Temperature (C) for 5th % indices	Arrival Date of 10th % Fish	Days to 10th % Arrival	Average Outflow (kcfs) for the 10th % indices	Average Temperature (C) for the 10th % indices
CW98_1	6/2/98	51.6	7/7/98	36	105.20	15.99	7/7/98	36	105.20	15.99
CW98_2	6/9/98	59.5	7/8/98	30	95.66	16.56	7/8/98	30	95.66	16.56
CW98_3	6/16/98	48.7	7/8/98	23	88.17	16.97	7/11/98	26	85.39	17.45
CW98_4	6/23/98	40.7	7/14/98	22	77.66	18.51	7/15/98	23	76.99	18.60
CW98_5	6/30/98	38.2	7/14/98	15	71.81	19.64	7/15/98	16	71.21	19.69
CW98_6	7/7/98	24.8	7/17/98	11	63.15	20.84	7/22/98	16	60.49	20.99

Appendix A. NMFS Fall Chinook Data at Lower Granite Dam, 1995-1998.

Release Site & Release Sequence	Release Date	Survival (%)	Arrival Date of 25th % Fish	Days to 25th % Arrival	Average Outflow (kcfs) for 25th % indices	Averge Temperature (C) for 25th % indices	Arrival Date of 50th % Fish	Days to 50th % Arrival	Average Outflow (kcfs) for the 50th % indices	Average Temperature (C) for the 50th % indices
PL95_1	5/31/95	65.6	7/22/95	53	94.71	16.80	7/29/95	60	89.32	17.30
PL95_2	6/7/95	64.8	7/26/95	50	85.07	17.47	8/2/95	57	80.45	17.87
PL95_3	6/14/95	59.6	7/30/95	47	76.87	18.37	8/6/95	54	72.71	18.66
BC95_1	6/1/95	64.4	7/22/95	52	94.17	16.84	7/29/95	59	88.75	17.34
BC95_2	6/8/95	59.4	7/26/95	49	84.04	17.56	8/2/95	56	79.47	17.96
BC95_3	6/15/95	59.4	8/1/95	48	74.70	18.53	8/8/95	55	70.75	18.79
AS95_1	6/19/95	49.9	8/4/95	47	69.10	18.93	8/11/95	54	65.45	19.16
AS95_2	6/27/95	46	8/9/95	44	60.38	19.90	8/26/95	61	53.31	19.78
AS95_3	7/5/95	38.8	8/16/95	43	50.98	20.34	9/9/95	67	44.17	20.00
PL96_1	6/6/96	55.9	7/18/96	43	109.92	15.40	7/28/96	53	97.23	16.43
PL96_2	6/13/96	52.8	7/25/96	43	85.66	16.68	8/1/96	50	79.07	17.37
PL96_3	6/20/96	39.1	7/31/96	42	65.68	17.92	8/5/96	47	62.67	18.24
PL96_4	6/27/96	24.7	7/18/96	22	68.27	17.59	8/12/96	47	52.56	19.37
PL96_5	7/3/96	12.4	8/6/96	35	50.10	19.89	8/20/96	49	46.30	20.14
PL96_6	7/10/96	5.4	8/12/96	34	42.25	20.59	9/2/96	55	40.60	20.10
PD96_1	6/13/96	57.1	7/25/96	43	85.66	16.68	7/31/96	49	79.92	17.29
PD96_2	6/20/96	53.8	7/30/96	41	66.39	17.84	8/4/96	46	63.24	18.19
CW96_1	6/6/96	56.7	7/22/96	47	104.39	15.79	7/29/96	54	96.11	16.53
CW96_2	6/13/96	54.5	7/26/96	44	84.63	16.80	8/1/96	50	79.07	17.37
CW96_3	6/20/96	36.2	7/31/96	42	65.68	17.92	8/5/96	47	62.67	18.24
CW96_4	6/27/96	26.2	8/2/96	37	57.22	18.99	8/6/96	41	55.22	19.15
CW96_5	7/3/96	13.4	8/8/96	37	49.30	19.93	8/23/96	52	45.88	20.13
CW96_6	7/10/96	6.3	8/6/96	28	43.94	20.54	9/5/96	58	39.79	19.89
PL97_1	6/3/97	57.3	7/2/97	30	155.86	14.69	7/8/97	36	143.70	15.15
PL97_2	6/10/97	62.2	7/7/97	28	137.41	15.74	7/11/97	32	129.02	16.11
PL97_3	6/17/97	58.2	7/13/97	27	109.20	16.90	7/20/97	34	99.72	17.36
PL97_4	6/24/97	48.8	7/18/97	25	84.07	17.81	7/30/97	37	76.74	18.28
PL97_5	7/1/97	23.7	8/2/97	33	68.13	18.75	8/15/97	46	63.71	19.05

Appendix A. NMFS Fall Chinook Data at Lower Granite Dam, 1995-1998.

Release Site & Release Sequence	Release Date	Survival (%)	Arrival Date of 25th % Fish	Days to 25th % Arrival	Average Outflow (kcfs) for 25th % indices	Averge Temperature (C) for 25th % indices	Arrival Date of 50th % Fish	Days to 50th % Arrival	Average Outflow (kcfs) for the 50th % indices	Average Temperature (C) for the 50th % indices
PL97_6	7/8/97	13.7	8/7/97	31	60.90	19.28	9/2/97	57	52.45	19.78
PD97_1	5/28/97	67.6	6/24/97	28	171.45	13.55	7/1/97	35	158.30	14.24
PD97_2	5/30/97	65.2	6/25/97	27	171.25	13.75	7/2/97	34	157.69	14.45
BC97_1	6/3/97	75.5	7/1/97	29	157.53	14.60	7/8/97	36	143.70	15.15
BC97_2	6/10/97	59.5	7/8/97	29	135.11	15.84	7/11/97	32	129.02	16.11
BC97_3	6/17/97	56.2	7/17/97	31	103.03	17.18	7/27/97	41	93.10	17.68
BC97_4	6/24/97	49.7	7/25/97	32	79.53	18.09	8/7/97	45	73.00	18.58
BC97_5	7/1/97	31	7/30/97	30	69.22	18.64	8/16/97	47	63.32	19.07
BC97_6	7/8/97	9.3	8/12/97	36	59.58	19.36	8/31/97	55	53.31	19.71
CW97_1	6/3/97	54.7	7/3/97	31	153.90	14.76	7/11/97	39	138.04	15.43
CW97_2	6/10/97	39	7/8/97	29	135.11	15.84	7/11/97	32	129.02	16.11
CW97_3	6/17/97	40.1	7/17/97	31	103.03	17.18	7/25/97	39	94.89	17.57
CW97_4	6/24/97	28.5	7/26/97	33	78.89	18.13	8/4/97	42	74.39	18.48
CW97_5	7/1/97	19.5	7/29/97	29	69.61	18.62	8/9/97	40	65.65	18.96
CW97_6	7/8/97	8.5	8/8/97	32	60.62	19.29	8/19/97	43	57.44	19.41
PL98_1	6/2/98	50.2	7/10/98	39	102.00	16.37	7/14/98	43	98.52	16.79
PL98_2	6/9/98	51.2	7/13/98	35	91.16	17.20	7/16/98	38	88.81	17.47
PL98_3	6/16/98	48	7/15/98	30	82.49	17.89	7/19/98	34	79.36	18.24
PL98_4	6/23/98	23.6	7/16/98	24	76.21	18.68	7/31/98	39	67.41	19.74
PL98_5	6/30/98	16.5	7/28/98	29	63.65	20.45	8/8/98	40	58.06	20.79
PD98_1	6/4/98	76.3	7/8/98	35	101.48	16.23	7/13/98	40	96.82	16.83
PD98_2	6/6/98	65.8	7/9/98	34	97.92	16.49	7/14/98	39	93.60	17.06
BC98_1	6/2/98	54.5	7/10/98	39	102.00	16.37	7/14/98	43	98.52	16.79
BC98_2	6/9/98	51.7	7/11/98	33	92.79	16.98	7/15/98	37	89.64	17.38
BC98_3	6/16/98	48.6	7/14/98	29	83.19	17.80	7/16/98	31	81.71	17.98
BC98_4	6/23/98	28.4	7/16/98	24	76.21	18.68	7/30/98	38	67.85	19.71
BC98_5	6/30/98	24.9	7/27/98	28	63.99	20.40	8/9/98	41	57.45	20.84
BC98_6	7/7/98	23.7	8/6/98	31	54.41	21.28	8/13/98	38	51.32	21.44

Appendix A. NMFS Fall Chinook Data at Lower Granite Dam, 1995-1998.

Release Site & Release Sequence	Release Date	Survival (%)	Arrival Date of 25th % Fish	Days to 25th % Arrival	Average Outflow (kcfs) for 25th % indices	Averge Temperature (C) for 25th % indices	Arrival Date of 50th % Fish	Days to 50th % Arrival	Average Outflow (kcfs) for the 50th % indices	Average Temperature (C) for the 50th % indices
CW98_1	6/2/98	51.6	7/9/98	38	103.03	16.24	7/14/98	43	98.52	16.79
CW98_2	6/9/98	59.5	7/11/98	33	92.79	16.98	7/16/98	38	88.81	17.47
CW98_3	6/16/98	48.7	7/15/98	30	82.49	17.89	7/18/98	33	80.11	18.16
CW98_4	6/23/98	40.7	7/17/98	25	75.40	18.79	8/1/98	40	67.01	19.76
CW98_5	6/30/98	38.2	7/22/98	23	66.38	20.16	8/8/98	40	58.06	20.79
CW98_6	7/7/98	24.8	8/6/98	31	54.41	21.28	8/16/98	41	50.22	21.49

Appendix A. NMFS Fall Chinook Data at Lower Granite Dam, 1995-1998.

Release Site & Release Sequence	Release Date	Survival (%)	Arrival Date of 75th % Fish	Days to 75th % Arrival	Average Outflow (kcfs) for 75th % indices	Averge Temperature (C) for 75th % indices	Arrival Date of 90th % Fish	Days to 90th % Arrival	Average Outflow (kcfs) for the 90th % indices	Average Temperature (C) for the 90th % indices
PL95_1	5/31/95	65.6	8/7/95	69	83.49	17.73	8/16/95	78	78.07	18.02
PL95_2	6/7/95	64.8	8/9/95	64	76.34	18.17	8/26/95	81	67.67	18.44
PL95_3	6/14/95	59.6	8/15/95	63	67.68	18.90	9/12/95	91	56.55	19.10
BC95_1	6/1/95	64.4	8/5/95	66	84.16	17.68	8/16/95	77	77.49	18.06
BC95_2	6/8/95	59.4	8/9/95	63	75.41	18.25	8/31/95	85	64.85	18.55
BC95_3	6/15/95	59.4	8/21/95	68	64.05	18.99	9/10/95	88	56.50	19.10
AS95_1	6/19/95	49.9	9/3/95	77	56.00	19.22	9/22/95	96	50.26	19.44
AS95_2	6/27/95	46	9/14/95	80	47.60	19.82	10/6/95	102	43.18	19.64
AS95_3	7/5/95	38.8	9/23/95	81	41.19	20.08	10/17/95	105	37.95	19.35
PL96_1	6/6/96	55.9	8/3/96	59	91.18	16.93	8/9/96	65	86.04	17.27
PL96_2	6/13/96	52.8	8/7/96	56	74.54	17.72	8/27/96	76	64.77	18.42
PL96_3	6/20/96	39.1	8/20/96	62	56.40	18.84	9/16/96	89	48.20	18.50
PL96_4	6/27/96	24.7	9/9/96	75	45.89	19.04	9/20/96	86	42.78	18.94
PL96_5	7/3/96	12.4	9/15/96	75	40.61	19.29	10/5/96	95	37.44	19.27
PL96_6	7/10/96	5.4	9/29/96	82	35.21	19.46	10/19/96	102	33.05	19.46
PD96_1	6/13/96	57.1	8/6/96	55	75.25	17.67	8/24/96	73	65.88	18.39
PD96_2	6/20/96	53.8	8/18/96	60	56.95	18.80	9/12/96	85	49.68	18.50
CW96_1	6/6/96	56.7	8/5/96	61	89.38	17.05	8/18/96	74	80.05	17.71
CW96_2	6/13/96	54.5	8/7/96	56	74.54	17.72	8/24/96	73	65.88	18.39
CW96_3	6/20/96	36.2	8/19/96	61	56.69	18.82	9/13/96	86	49.28	18.50
CW96_4	6/27/96	26.2	8/31/96	66	48.64	19.44	9/28/96	94	41.45	18.94
CW96_5	7/3/96	13.4	9/20/96	80	39.60	19.27	10/5/96	95	37.44	19.27
CW96_6	7/10/96	6.3	9/28/96	81	35.34	19.46	10/19/96	102	33.05	19.46
PL97_1	6/3/97	57.3	7/11/97	39	138.04	15.43	7/19/97	47	124.92	16.02
PL97_2	6/10/97	62.2	7/17/97	38	118.12	16.54	7/26/97	47	107.53	17.04
PL97_3	6/17/97	58.2	8/1/97	46	89.36	17.88	8/19/97	64	78.49	18.43
PL97_4	6/24/97	48.8	8/14/97	52	70.08	18.74	9/1/97	70	62.26	19.20
PL97_5	7/1/97	23.7	9/3/97	65	56.21	19.55	9/22/97	84	51.15	19.97

Appendix A. NMFS Fall Chinook Data at Lower Granite Dam, 1995-1998.

Release Site & Release Sequence	Release Date	Survival (%)	Arrival Date of 75th % Fish	Days to 75th % Arrival	Average Outflow (kcfs) for 75th % indices	Averge Temperature (C) for 75th % indices	Arrival Date of 90th % Fish	Days to 90th % Arrival	Average Outflow (kcfs) for the 90th % indices	Average Temperature (C) for the 90th % indices
PL97_6	7/8/97	13.7	9/12/97	67	48.96	20.14	9/23/97	78	47.46	20.21
PD97_1	5/28/97	67.6	7/9/97	43	144.49	14.86	7/18/97	52	130.37	15.55
PD97_2	5/30/97	65.2	7/11/97	43	141.14	15.17	7/24/97	56	122.76	16.05
BC97_1	6/3/97	75.5	7/10/97	38	139.85	15.34	7/15/97	43	130.57	15.71
BC97_2	6/10/97	59.5	7/17/97	38	118.12	16.54	7/25/97	46	108.60	16.99
BC97_3	6/17/97	56.2	8/9/97	54	84.16	18.19	8/25/97	70	75.35	18.64
BC97_4	6/24/97	49.7	8/23/97	61	66.11	18.95	9/10/97	79	58.51	19.54
BC97_5	7/1/97	31	9/4/97	66	55.80	19.58	9/19/97	81	51.55	19.98
BC97_6	7/8/97	9.3	9/16/97	71	48.08	20.22	9/22/97	77	47.56	20.22
CW97_1	6/3/97	54.7	7/18/97	46	126.24	15.95	7/26/97	54	116.83	16.42
CW97_2	6/10/97	39	7/17/97	38	118.12	16.54	7/24/97	45	109.64	16.94
CW97_3	6/17/97	40.1	8/6/97	51	86.02	18.10	8/25/97	70	75.35	18.64
CW97_4	6/24/97	28.5	8/19/97	57	67.84	18.83	9/8/97	77	59.25	19.47
CW97_5	7/1/97	19.5	8/23/97	54	60.56	19.23	9/19/97	81	51.55	19.98
CW97_6	7/8/97	8.5	9/9/97	64	49.94	20.05	9/18/97	73	47.96	20.23
PL98_1	6/2/98	50.2	7/17/98	46	95.93	17.05	7/28/98	57	87.81	17.90
PL98_2	6/9/98	51.2	7/24/98	46	82.87	18.14	8/6/98	59	74.96	18.91
PL98_3	6/16/98	48	8/6/98	52	68.86	19.41	8/19/98	65	62.31	19.91
PL98_4	6/23/98	23.6	8/13/98	52	60.39	20.30	9/12/98	82	48.09	20.86
PL98_5	6/30/98	16.5	8/18/98	50	53.61	21.02	9/20/98	83	42.84	21.38
PD98_1	6/4/98	76.3	7/16/98	43	94.35	17.09	7/25/98	52	87.43	17.81
PD98_2	6/6/98	65.8	7/17/98	42	91.11	17.33	7/27/98	52	83.94	18.12
BC98_1	6/2/98	54.5	7/17/98	46	95.93	17.05	7/23/98	52	91.16	17.55
BC98_2	6/9/98	51.7	7/22/98	44	84.18	18.00	8/3/98	56	76.68	18.73
BC98_3	6/16/98	48.6	7/28/98	43	73.98	18.95	8/10/98	56	66.58	19.61
BC98_4	6/23/98	28.4	8/12/98	51	60.79	20.24	8/28/98	67	53.52	20.49
BC98_5	6/30/98	24.9	8/20/98	52	52.93	21.03	9/21/98	84	42.68	21.38
BC98_6	7/7/98	23.7	9/10/98	66	40.82	21.58	10/1/98	87	37.78	21.54

Appendix A. NMFS Fall Chinook Data at Lower Granite Dam, 1995-1998.

Release Site & Release Sequence	Release Date	Survival (%)	Arrival Date of 75th % Fish	Days to 75th % Arrival	Average Outflow (kcfs) for 75th % indices	Averge Temperature (C) for 75th % indices	Arrival Date of 90th % Fish	Days to 90th % Arrival	Average Outflow (kcfs) for the 90th % indices	Average Temperature (C) for the 90th % indices
CW98_1	6/2/98	51.6	7/18/98	47	95.05	17.13	7/26/98	55	89.04	17.75
CW98_2	6/9/98	59.5	7/23/98	45	83.53	18.08	8/7/98	60	74.34	18.96
CW98_3	6/16/98	48.7	8/2/98	48	71.21	19.17	8/13/98	59	65.16	19.74
CW98_4	6/23/98	40.7	8/13/98	52	60.39	20.30	8/30/98	69	52.63	20.52
CW98_5	6/30/98	38.2	8/19/98	51	53.24	21.03	9/15/98	78	43.60	21.35
CW98_6	7/7/98	24.8	9/11/98	67	40.67	21.60	9/25/98	81	38.63	21.64